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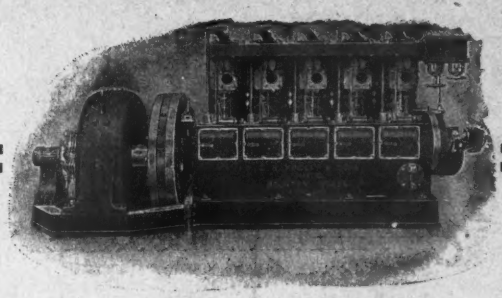

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NATIONAL ADAPTABILITY IN WAR TIME.

AGAIN and again during the war, as the Allies' policy has been developed by the course of events, we have found it necessary to alter our manner of dealing with many matters. What seemed to be a proper decision and policy at one particular stage was not suited to another, and we have had to adapt our methods, and our arguments relating to them, in accordance with the changes. Looking backward after two and a quarter years of warfare such as the world has never witnessed before, we have to recognise changes that might under some circumstances be regarded as strange inconsistencies of conduct, but which considering all things have not been inconsistencies at all, and for which no excuse is needed bearing in mind all the exigencies—that could not possibly be foreseen—that have arisen.

It may be interesting to review some of the points that we have in mind; we are led to do so by the issuing of a notice by the Board of Trade, which appeared in our last issue, expressing its willingness now to entertain applications for provisional orders in the ensuing Parliamentary session if it can be shown that the establishment of works under the schemes proposed will be proceeded with as soon as practicable after the war. Last year the Board intimated that such applications would only be considered where extreme urgency could be shown to exist. As our readers are aware, some electrical undertakings, by virtue of war demands, have received special facilities, but others have had to defer all extension work involving the expenditure of new capital, and among these there have been cases of extreme difficulty leading to the stoppage of electrical progress. Indeed, there are places where new connections not only will not be handled during the war, but the restrictive conditions are expected to obtain for some time after the war, until new plant is available. When the first shock of war shook the nation, actual experience, as well as apprehensions, led to an appeal being made to authorities at home and in the colonies asking them not only to refrain from cancelling contracts already placed, but to assist British works over a period of industrial emergency by giving them all the business possible. The late Lord Kitchener in those days issued his appeal for men, and our class of workers from all ranks, high and low, hastened to the Colours, manufacturers in many cases giving inducements of all kinds to assist the movement. But the kaleidoscope of war soon made the first of its so frequent changes, and munitions, unlimited munitions, became the clamorous demand. Then in place of the appeal for contracts to keep the factory

wheels turning, came the discounting of private work and the imperative demand for the whole available suitable manufacturing capacity to be reorganised and readjusted, and much more to be added, for the purposes of war requirements. It was becoming apparent that it was an engineers' war, and nothing that hindered the provision of the necessary material could be permitted. Private manufacturing and contracting operations had to a large extent to be set aside. Buyers abroad who had only a little while before been urged to buy were now being disappointed in deliveries, and found that the Mother Country was so busy with her war work that she could not meet their needs, at any rate with the promptitude they desired. Some of them could not, or would not, wait—they turned to neutral countries, and these are now still supplying them, perhaps to a greater extent than the present situation requires, but others patriotically deferred their orders, preferring to suffer inconvenience for a season, until circumstances perforce compelled them to defer action no longer. To-day, as the organisation of our industries has been highly developed, and as vast new factories and equipments have been put down and large accessions of new labour of both sexes have been trained, the pressure of Government demands upon private factories is relieved somewhat, and they are freer to undertake certain classes of manufacturing. In the early months of war, when it was unknown how essential skilled engineering workers would be, because it was overlooked that we were to fight the entire and enormous industrial system of Germany organised for war, engineering and allied workers flocked to the Colours. But, later, when the demand for engineering munitions was beginning to be understood, the pressing need for skilled workers occupied our serious attention, and factories, from which by inducement and encouragement sometimes of a liberal kind, the exodus was facilitated, urgently needed their workers back again. In some cases they were selected and returned from the fighting line, or when home on sickness, on leave, or slightly disabled, were returned to their then very essential service at home, other fighting men being available to take their places. Then the demand was for more munitions, and those were anxious days for the Allied cause, such as we trust, and are assured, will never return. To-day there is another kaleidoscopic turn in process, and the cry once again is for more men. Thanks to the new factories and to the new and diluted labour, and the co-operation of the workers, the munition-making facilities are all that are required, and when the Minister of Munitions becomes Minister of War, with all his experience of the munitions problem, the unbadging of the unessential is found to be the most important need of the moment. The appeal is for the younger men, whether skilled or not, after having served their country well in her hour of need, to take their rightful place with the fighting forces and allow others to take their place, if need be, at the bench. Whether munitions work has been turned to as an accommodating shelter by those who should have been more ready for the other call is not our concern here; munitions were urgently needed, and the need was well met, and those who worked at them had, in most cases, their full reward. We had to feel our way gradually, doing what seemed to be the best thing at the time. Many of the badged, we believe, were anxious to fight, and will welcome the withdrawal of the badge; others were not so, and they are being led aright. What is now the unquestionably strong feeling of the country is that no young man shall be badged to-day who is not really absolutely indispensable, and upon the interpretation of this word will probably rest the revision of the lists of certified occupations. Industry, not slow to recognise the necessity for loyalty to the greatest cause ever fought for, will not withhold its co-operation in this difficult matter.

The latest change in the scene, to which we have referred in our opening remarks, is as hopeful as it is interesting to industry. It is not a change either in engineering works policy or in the department of labour. It amounts to the removal of an embargo on enterprise, and it is a further illustration of the fact that if we "leave after the war to look after itself" we shall be neglecting certain very serious responsibilities. If we are going to find work for all our factories, so as to give "work for all" who need it, we must look ahead, and the Board of Trade is to be congratulated upon its timely announcement, though it may be it is rather late for the coming Session if notices have to be lodged by the usual date. Under stress of war demands it was necessary to put obstacles in the way of expenditure upon certain kinds of works, as we have stated. Further, there was neither the time nor the disposition to discuss the details of works that could reasonably wait. To-day most people see the need for preparing for another state of things than that prevailing just now, and they remember that preliminaries in connection with certain classes of public work do not generally suffer from too much expedition. The Board, in intimating to the Society of Parliamentary Agents its willingness to entertain proposals, recognises that the position has altered since last year's notice, and it is now ready to consider applications for provisional orders which will make work soon after the war ends, and will afford an outlet for labour or for the utilisation of plant and machinery which have been provided for the purposes of war.

It is, of course, necessary to include a reservation to the effect that the policy of the Board in dealing with these applications may be subject to further modification "in the event of a change in the general situation due to the war." This is as it should be—optimism is good, but cocksure miscalculations we prefer to leave to the Prussian mind. The announcement is a reminder to us that, though there will be changes, strange, pathetic, and remarkable in almost every walk of life after the war, there will be some things going on much the same as before—we shall be applying for provisional orders for gas and water works, docks, electricity works, tramways and light railways, and providing a certain amount of work by these means. The Board of Trade and Parliament will probably do their utmost under the altered circumstances to expedite approvals, and will not so often obstruct enterprise as in the past, because work for all will be the aim of all. The announcement may, we think, be considered to be one small item in the whole programme of preparation for Demobilisation, and all who are interested in electrical and other public concerns should have their plans prepared in good time. The matter should be attended to now as far as that is practicable without in any way interfering with the progress of the vital operations connected with the war.

Copper. There has been a phenomenal demand for copper again in the last few weeks, chiefly in connection with the constant requirements of belligerent countries on the Allies' side, and this has obviously done much to accelerate a further upward movement in prices for all kinds of material, whether of copper itself or allied products. The big trans-Atlantic producers have made huge sales of refined metal to domestic consumers and for export combined, and there is not now much doubt that the market is bare of supplies for anything like near deliveries,

so that the tendency remains entirely in favour of holders. The cost of electrolytic now ranges from about £138 upward, according to position, but the high prices under present abnormal conditions do not seem to have much effect on the attitude of consumers, whose anxiety at this juncture is to have their needs well provided for in anticipation of further tightness over the winter months. War needs admittedly have been covered well ahead, but the fact remains that with but little to be had, American views, having regard to the future course of the market, are more optimistic than ever. American manufacturers are conducting operations on an unprecedentedy heavy scale, which is likely to continue for an indefinite period, so that the current refineries' output must be expected to be fully taken up in view of the heavy contracts awaiting execution for export. It is probable that the unsold stocks on the other side have, in the last few months, practically disappeared, for the exports were not only abnormally heavy, but the deliveries from the refineries were rather short of actual needs, due to the setback in refinery operations during the hot months. The refinery output, as a matter of fact, is still considerably short of the huge tonnage reached towards the middle of the year.

Operations are now steadily improving, but it is doubted whether the output will be restored to high-water mark until the early months of the coming year, when new refinery capacity becomes available. Supplies from other sources than America are for the present limited, since producers in that direction too are very well sold ahead. Shipping arrangements for Russia have been for the present about completed, but it is probable that gaps will have to be filled elsewhere this side of Christmas, which is likely to keep the tendency on the firm side. The total shipped by America during June, July, and August represents some 107,000 tons, which compares with about 52,000 tons for the same period in the previous year, an increase of 55,000 tons. The fact is worth noting that America is now also shipping much larger quantities of manufactured copper to this side. The apparent growing scarcity of metal, as indicated to some extent by the absurdly small quantities left in official warehouses, has dominated the market for standard copper, which has again risen steadily up to about £118, for near delivery, which commands a big premium over the price for forward delivery. Dealings in warrant copper, however, remain in exceedingly narrow compass, as speculation is prohibited. The demand from sulphate makers has abated somewhat, but rough Bessemer copper is held for full prices. At the extravagant level of values ruling, there is naturally more inducement to push production, and there should eventually be more than sufficient metal to go round, but for the present buyers are largely in the hands of the sellers.

The Reorganisation of Industry.

We recently drew attention to the excellent address delivered by Mr. Gerald Stoney at the meeting of the British Association, in which the President of the Engineering Section dealt with the internal reorganisation of factories with a view to the attainment of a higher degree of efficiency of production. In his presidential address to the Economic Science Section, of which we conclude an abstract in this issue, Prof. A. W. Kirkaldy discussed with equal insight and understanding the broader problems of external reorganisation which will arise in the near future, and which demand the most earnest consideration of employers and workers. Referring to the immense economic waste entailed by the war, he pointed out that, after all, there was a brighter side to the question—it was not all dead loss. Both morally and physically the nation had benefited from the bitter lesson it had learnt, and its faults and weaknesses had been remorselessly laid bare, the first essential to their amendment. So far as our industrial future is concerned, Prof. Kirkaldy is distinctly optimistic; he holds that American and Japanese competition will not materially affect our foreign trade, and that our chief opponents in the industrial field will be the Germans, who possess appreciable advantages and will exert every effort to regain their old position in the trade of the world, no matter what the cost. This is indeed their only hope; and if we return to the condition of industrial strife and friction that prevailed in this country before the war, we cannot hope to be successful in the conflict—nay, rather, our failure is a certainty. Above all, our rate of production must be maintained at the highest possible value.

Yet our Government has undertaken to restore all the trade union agreements and restrictions that have been waived during the war—and that guarantee must certainly be fulfilled, if the workers demand it; but will they? Surely the lessons of the war will not have fallen on deaf ears; a nation that could rise to the height already attained in this great crisis is not a decadent or stupid race, and we confidently look forward to the manifestation of enlightened views on the part of the workers when the time arrives for the resumption of their normal occupations. But it is not only the workers who have lessons to lay to heart, and Prof. Kirkaldy insists on the necessity of fundamental reorganisation of what he calls the "Industrial Army of Labour"—including under this head the captain of industry equally with the unskilled labourer. Our business men, he says, have hitherto worked as independent units; in future they must combine their forces, and work as members of associations—not with the lack of sympathy and co-operation that has been so deplorably manifest in the past, but with sincerity and zeal. How often have we complained of the inveterate prejudice against hearty and complete co-operation that has betrayed itself whenever attempts have been made to bring British manufacturers together for a common object! Unfortunately, as the professor states, not only has half-hearted adhesion been given to such movements, but also there has been a lamentable want of loyalty to agreements entered into by associations on behalf of their members. This want of loyalty and tendency to isolated and independent action has been still more strongly in evidence, because more publicly displayed, in connection with the workers' trade unions, and Prof. Kirkaldy truly declares that in both cases success depends on *absolute loyalty to the pledged word*—without which industrial harmony cannot be achieved.

For the details of the system of organisation which he proposes we refer our readers to the abstract of the address. His remarks on the subject of the return of the Army to industrial pursuits are also worthy of attention, and in this connection the report of the committee on the replacement of men by women in industry, abstracted on a later page, is of interest. It is held that, apart from the sad roll of those who have given, and will give, their lives and limbs for their country, many men will not return to indoor life, and at least one million will remain under arms; it should not be forgotten, too, that a large proportion of our citizen soldiers are drawn from other than industrial ranks. Moreover, our financial position is sound, and there is every prospect of a period of good trade after the war. There may even be a marked shortage of labour, in spite of the greatly increased adoption of automatic machinery and improved methods of production consequent upon war conditions. We look forward to the future without any qualms, confident that if employers and employed will work together for the common good, our future prosperity is assured.

MUNICIPAL TRAMWAYS ASSOCIATION CONFERENCE.—II.

Goods Traffic on Tramways.

At the recent meeting of the Municipal Tramways Association, Messrs. G. W. Holford, of Salford, and W. Clough, of Bury, read a paper on the "Utilisation of Tramways for Goods Traffic," in which they gave a short history of the subject so far as South Lancashire is concerned, briefly described the operation of goods traffic on several Yorkshire and Lancashire tramway systems, and roughly examined the question of the powers of tramway authorities to undertake such work.

It may be recalled that years ago the Douglas and Laxey line in the Isle of Man and the Bessbrook and Newry line in Ireland both catered for goods traffic.

In the South Lancashire area the object in view has generally been to provide speedier transit than under existing conditions between the manufacturing centres and the Liverpool and Manchester docks.

Mr. Gibbings dealt with the subject before the Institution of Electrical Engineers at Manchester in 1903; Mr. Bellamy touched on it at the Municipal Tramways Conference at Liverpool in 1904, and subsequently the tramway managers in this area have discussed the problem, without, however, finding a solution of the question of loading and unloading facilities.

In 1913, at the Tramways and Light Railways Association Conference, Mr. Edwardes referred to the subject again, and, more recently, Mr. Mallins has considered the conveyance of goods from the Liverpool docks over the Corporation system, but we gather that the Dock Board has not favoured the idea so far. The authors point out that Southern Lancashire is an ideal area for such a scheme; the continuous tramway network of the Corporations of Ashton-under-Lyne, Bolton, Bury, Liverpool, Manchester, Oldham, Rochdale, Salford, Stalybridge, Stockport, and Wigan, together with the Lancashire United and Oldham, Ashton and Hyde Co.'s systems cover 403 miles of 4 ft. 8½ in. route; it has also been pointed out by Mr. Mozley that there is a considerable mileage of 4-ft. gauge interconnected tramways in North Lancashire, and similar interconnected tramway systems exist in West Yorkshire, although we believe there is a considerable variation in gauge in the latter case, which would complicate the use of the track by purely tramway vehicles for through traffic, though, of course, it would not prevent the development of a local goods carrying service such as was recently suggested by Mr. J. B. Hamilton, the manager of the Leeds tramways for his city. The authors point out that under municipal management traffic can be dealt with on well organised lines with fares and services fixed on an equated basis, but if half-a-dozen or more private individuals were catering for passenger traffic then disorganisation would follow; they think that similar organisation would also benefit the transport of merchandise over certain areas, and urge that it is a matter for consideration of the whole of the parties interested.

Amongst the various instances of goods carriage on tramways, the authors cite Burnley, where a goods wagon was propelled in front of an ordinary car for the conveyance of heavy parcels weighing between 56 lb. and 5 cwt. The charges were based on 3d. per cwt. per package with a minimum charge of 3d. The financial results were not satisfactory, and the daily running of the wagon has been abandoned, but it is now run for a guaranteed load of not less than 4s. carriage.

At Glasgow the Corporation track is used for the conveyance of material from a railway station to one of the shipbuilding yards, a distance of half-a-mile, for which the Corporation charges 2d. a mile; the company uses an electric locomotive for hauling and 1d. per unit is also charged for electricity; as much as 160,000 tons per annum has been dealt with.

Since 1904 the Huddersfield tramways have carried coal from the railway to three different mills, two of which are three miles distant, and the other five miles. The Corporation siding to the railway cost £1,243, and the other sidings were built by the mill owners. Two self-propelled tramway trucks were built, each equipped with two 45-H.P. motors. During the year to March, 1916, 12,121 tons of coal were carried.

In 1910 the Leeds Corporation tramways carried some 30,000 tons of sand for the waterworks department, a distance of 3½ miles, suitable wagons with hoppers being provided. The revenue was, roughly, £1,900, and a satisfactory net profit resulted. More recently an agreement has been entered into for carrying fireclay and coal for a local firm, a distance of five miles, across the city, and Mr. Hamilton, the tramway manager, is preparing a scheme for general mineral and goods carriage over the city tramway system (as already mentioned in our columns).

Many tramway undertakings convey their own permanent-way materials, and some special parcel-carrying vans have been provided.

The authors quote the judgment of Mr. Justice Farwell, in the High Court, in 1906, in the action by Messrs. Sutton and Co. for an injunction to restrain the Manchester Corporation from acting as carriers or delivery agents except on their tramways, and from expending any of the Corporation moneys for that purpose. They then inquire briefly into the powers of tramway authorities in the matter of goods conveyance, and come to the conclusion that (1) tramways have powers to convey goods on tramways; (2) that no difficulty need be anticipated in obtaining consent to run attached vehicles; (3) that there is no power granted to construct lines into railway or mill yards which are not owned by the Corporation, and that such lines would have to be privately constructed—although this view was contradicted in the discussion.

The authors point out that although the original 1870 Tramways Act apparently intended that, if necessary, the same vehicle should be used on tramways and railways, later Acts (such as the Salford and Bury Corporation Acts) contain a clause expressly prohibiting the use of railway vehicles on tramways; on referring to the Standing Orders relating to Bills deposited in Parliament, it is found that provision is still made for the running on tramways of "carriages or trucks adapted for use upon railways," and the authors conclude that the prohibition clause has been inserted into Municipal Acts which only provide 9 ft. 6 in. between rail and kerb, to comply with the Standing Order covering that matter, which, no doubt, is to provide for the greater overhang of railway vehicles.

Railway wagons cannot run along tramways as at present constructed, because the overhang is much more than the tramway allowance of 11 in.; also the railway wheels are 5 in. wide, with a 1-in. flange. Tramway wagons cannot be used on railways, because the wheels are too narrow to pass over the gap of 4 in. in railway crossings and the flanges too small to safely negotiate curves.

The authors consider that for transit between towns some distance apart, with loads of a moderate character, tramway charges would be cheaper than present railway charges; taking 25 miles, and making no allowance for return load, the tramway rate would be 41s. 8d., or 4s. 2d. per ton, whereas an actual railway rate is 13s. 2d. per ton, and this leaves a large margin out of which to provide warehousing or loading facilities.

Sidings might facilitate the collection of goods, but would involve more points and crossings, which are undesirable on passenger routes, and in narrow streets sidings are impossible.

Mr. Edwardes, in his paper, said he found that the small amount of tonnage handled in the average mill would not pay interest and sinking fund on the cost of a siding.

Traffic between adjacent towns, the authors think, can only be done by the use of a vehicle which could use the tramways and yet be on equal terms with independent vehicles in the handling of goods; the same consideration applies to traffic between dock and railway yards and mills and warehouses.

A vehicle of the type indicated has been introduced by Mr. C. J. Spencer, manager of the Bradford tramways, and was illustrated and described in our issue of May 19th last.

Between May 15th and June 17th this vehicle (which consists of a railless trolley vehicle adapted for use over the tramway route and fitted with a battery to enable it to operate independently when necessary) ran 741 miles,

carrying 247 tons and earning £74; and making allowance for periods when it was withdrawn for private reasons, the earnings would have been £91. The estimated first cost is £800 or £900.

Mr. Spencer considers that it would cost £10 per week of 6 days, running 240 miles, to operate, as against £12 5s. for a petrol vehicle.

Mr. C. J. Spencer (Bradford), in opening the discussion, congratulated the authors on their paper; the subject was most opportune. They had to consider how they might assist in the transport problems of the future, and it was necessary to ascertain whether tramways could be used for goods traffic on a financially successful basis. On the basis of the cost of operating their cars at present, it might cost, say, 2d. per ton-mile to handle goods traffic, and although the latter cost might be increased under goods transit conditions, there would be savings in capital cost, tickets, conductors, &c. Goods traffic would improve the tramway load factor. Electric power was considerably cheaper than petrol power, but other conditions had to be studied; from the public point of view, the cost of road provision and maintenance should be charged to petrol costs. Would the proposal reduce street congestion? He thought the public control of goods transit would result in as much improvement as in the case of passenger transport. It was a question of substituting an organised for a disorganised system.

Mr. H. Mozley (Burnley) said the railways did not care to be troubled with the short local traffic round towns. There had been difficulties in carrying goods on tramways on account of statutory charges; now these difficulties were to some extent overcome. Night traffic would, however, be intolerable, and goods traffic could be worked in with the passenger traffic during the day. At Burnley they were endeavouring to cater for the "carrier" traffic to the outskirts, and this required a combined "road and rail" vehicle, which, he believed, was the solution of the problem. If they were to adopt the Bradford system, they would have to go to Parliament for fresh powers to use heavy motor vehicles. He pointed out that, contrary to the authors' statement, his Council had powers to build sidings into works, and he thought others had also.

Mr. J. B. Hamilton (Leeds) said there were two points of view; one was the relief of traffic congestion, and the other point of view was the financial one. In Leeds they had superseded cumbrous steam tractors, and he believed that they could deal with mineral at less cost than was possible with steam or petrol. They were satisfied that they could not touch the business with the statutory charges, and so an arrangement had been come to, and they charged 3d. per ton-mile for the distance of five miles, and were just making it pay.

Mr. Wilkinson (Huddersfield) pointed out that the authors' costs for 10 tons at 10d. per mile, would be much reduced if the weight were doubled. Some years ago he had to consider the question of handling 100,000 tons per annum, and he was confident that he could have conveyed the goods on a 3d. per ton-mile rate. The idea was to carry the whole railway truck on a bogie running on the tramways. Similar work had been done in Germany, and in one case he had found a rate of 6d. per truck-mile, using a 10-ton truck.

Mr. McElroy (Manchester) said tramways were originally constructed because it was recognised that a metal wheel on a metal rail gave cheap traction. Passengers collected and delivered themselves; but immediately they considered the carriage of goods, the question of terminal facilities arose. Tramways would be quite suitable for this if sidings into works could be made. He felt that in view of the great progress made in petrol, steam, and other vehicles, they must hesitate before they agreed to tackle the general problem of goods carriage.

Mr. Clough (Bury), in replying, assured them that 3d. per ton-mile was a paying rate. They had not suggested night traffic, as there was plenty of opportunity to deal with it in the day. He agreed that powers would have to be obtained to make use of vehicles such as those employed at Bradford, for regular goods traffic.

THE NATIONAL INSURANCE ACT, 1911.

Umpire's Decisions on Unemployment Insurance.

By JOS. J. H. STANSFIELD, F.C.I.S.

Following the passing of the National Insurance (Part II) (Munition Workers) Act, 1916, and the order of the Board of Trade dated September 1st excluding certain classes of munition works from unemployment insurance, a large number of applications have been made to the Umpire for his decision as to whether contributions are or are not payable.

As some of these decisions affect the electrical industry, they are given below as advertised in the *Board of Trade Journals* issued up to September 28th, 1916. Decisions in which the Umpire has decided that contributions are payable are indicated by the letter X following the number of the decision.

Contributions are payable under these decisions as from September 4th, 1916.

Contributions are Payable for

Mechanical Engineering.—1,651 X. Smiths, stampers, piercers, and other workmen engaged in general oddwork on metal goods.

1,654 X. Workmen engaged in polishing, plating, or enamelling metal goods, whether carried on as a separate business or in conjunction with other manufacturing processes, and whether in connection with articles intended for use in war or not.

Electrical Engineering.—1,690 X. Workmen engaged in (1) armature and coil winding, (2) mica and insulation cutting, and (3) commutator assembling in connection with the manufacture of electrical machinery and instruments.

1,691 X. Workmen engaged in the manufacture of electrical recording, measuring, and testing instruments, such as ammeters, voltmeters, meggers, &c.

1,692 X. Workmen engaged in the manufacture (including assembling) of sparking plugs and magnetos.

1,693 X. Workmen (other than those engaged in the manufacture of porcelain parts) engaged in the manufacture (including assembling) of small electrical switches, fuses and lampholders.

1,694 X. Workmen engaged in the manufacture of electrical batteries and accumulators.

1,760 X. Workmen employed by switchgear manufacturers, and engaged in drilling slate bases for electrical machinery which is intended for use in war, or in the manufacture of munitions of war.

1,793 X. Workmen engaged in making wooden crates for packing purposes.

1,814 X. Workmen engaged in making small ebonite or vulcanite parts of electrical appliances such as magnetos, sparking plugs, &c. (and not covered by decision A 1,230, see *Board of Trade Journal*, January 2nd, 1913).

1,818 X. Workmen engaged in the manufacture of metal filaments for electric glow lamps.

1,853 X. Workmen described as machine or hand nailers, hoopers, dovetailers, conveyor attendants, or truckers engaged in connection with the manufacture of wooden cases.

1,914 X. Workmen employed wholly or mainly in the manufacture or repair of telephone and telegraph instruments and signalling apparatus.

Cables, Overhead Lines and Street Lighting.—1,711 X. Workmen employed by electric cable manufacturers and engaged in (1) stranding wire, (2) insulating with rubber or gutta-percha, and (3) lead sheathing and armouring.

1,713 X. Workmen engaged in the manufacture of rubber solution.

1,805 X. Workmen engaged in proofing flax, jute, cotton, asbestos or other fabrics with rubber.

1,806 X. Workmen engaged wholly or mainly in the manufacture of carbon electrodes for use in the production of munitions of war.

Generation and Supply of Electrical Energy.—1,763 X. Workmen employed by coke manufacturers and engaged wholly or mainly in connection with the operation of by-product plant for the recovery of light oils or other chemicals from the waste gas or tar.

1,764 X. Workmen employed at gas works or at gas by-products and engaged wholly or mainly in the distillation of tar or in the extraction of light oils from tar or oil.

1,807 X. Workmen engaged wholly or mainly in the manufacture of carbide of calcium.

Contributions are NOT Payable for

Electrical Engineering.—1,695. Workmen (other than metal filament and metal cap makers) engaged in the manufacture of electric glow lamps, unless these are intended for use in war.

1,714. Persons described as calibrators or test-room assistants and engaged mainly in calibrating or testing electrical instruments.

1,785. Workmen engaged in the manufacture of metal conduit fittings for electrical conduit tubes, including assemblers, enamellers, finishers, packers, and general labour employed on the premises in connection with such manufacture (excluding workmen engaged in ironfounding in respect of whom contributions are payable under Part II of the National Insurance Act, 1911).

Cables, Overhead Lines, and Street Lighting.—1,665. Workmen employed by a rubber merchant, and not employed in connection with the manufacture of rubber or rubber goods.

1,710. Workmen employed by electric cable manufacturers and engaged in insulating cables with paper, fibre or similar material other than rubber or gutta-percha not intended for use in war.

1,789. Workmen (other than those engaged in the manufacture of rubber thread) engaged wholly or mainly in the manufacture of elastic or rigid braids or webbing.

Generation and Supply of Electrical Energy.—1,848. Workmen employed by coke manufacturers, and engaged wholly or mainly in connection with the working of the coke ovens, and not covered by decision 1,763 X (see above amongst "payable" decisions).

1,905. Workmen engaged in the outdoor repair and maintenance of overhead, third rail, conduit, surface contact or cable equipment of railways, tramways, light railways or electric power supply undertakings.

1,906. Workmen employed by electricity supply companies as meter fixers or readers, fuse hands, crane men, boiler cleaners, or in any of the occupations set out in decision B 264 (*Board of Trade Journal* of July 4th, 1912) (also see p. 277 Electrical Review, August 16th, 1912).

In 1912 the Board of Trade made an order exempting drivers and attendants of any vehicles, and stablemen or other workmen employed in attending horses or cleaning any vehicle. This has been slightly modified by decision 1,866 X, which states that "drivers or attendants of vehicles employed in connection with insured trades, and employed mainly on the premises on which such trades are carried out," must be insured for unemployment insurance.

GAS AUTHORITIES AS SUPPLIERS OF ELECTRICITY.

By J. W. NAPIER.

At the annual meeting of the North British Association of Gas Managers at Edinburgh, on September 1st, Mr. J. W. Napier, of the Alloa Gas and Electricity Works, read a paper, of which the following is an abstract:—

The object of the author in presenting this paper is to create an interest in the supply of electricity as an agent in providing light, power, and heat for public needs, and to show that the dual supply can most profitably be given by the existing authority for gas supply—company or municipality—having regard to the economics of the question from the point of view of both the supplier and the consumer. The author does not wish to discuss the merits of the illuminants as such, or, indeed, to consider gas and electricity as rivals—this is a fast disappearing conception, and happily so—and disclaims any idea of opposition to purely gas interests. It is not intended that this review of the subject should have reference to the larger towns or to areas already supplied by electricity authorities having Parliamentary powers.

In these times of change and overthrow it becomes us to take a fresh perspective of events and conditions of things so that the horizon of our outlook may be widened and the scope of our responsibilities broadened and strengthened. In this regard the trend of things has undoubtedly been towards centralisation of supply, no matter what the commodity may be. Competition as a factor in serving the public interests most economically has been of great value, but it may be carried beyond the limit of sound judgment, and it is to be remembered that the supply of gas and electricity as a monopoly in the hands of one party has the safeguarding and watchful control of Parliament. The author is aware that in Scotland several gas supply companies have for some time past been seriously considering the supply of electricity. There are several instances where Parliamentary power has been granted to gas companies for electricity supply, notably the Tottenham District Light, Heat, & Power Co.

The Alloa Electric Lighting Order was obtained in 1899, and the Town Council immediately concluded an agreement with a company for a bulk supply to be continued during a minimum period of 14 years. The arrangement was that the Corporation took delivery of the current at a sub-station in the town, and thereafter themselves undertook the distribution, having provided and laid down at their own expense the street cables. The arrangement for supply from the company was doomed to failure, and this was entirely due to the excessive rates of charge imposed upon the Town Council. In order to end the unfortunate position of affairs, after ten years the arrangement with the bulk supply company was terminated by mutual agreement, the Corporation to pay an indemnity of £3,000, spread over a period of six years. The full sum has now been paid.

It was now possible to decide upon the erection of a station. The gas works site was utilised, and has proved most satisfactory.

Suction producer gas plant with gas engines was decided upon as the most economical type of plant, best suited to the local circumstances.

In 1910 the plant first put down consisted of one 85-B.H.P. and one 140-B.H.P. gas engines with dynamos direct coupled, with one producer gas plant for use with gas coke, and a storage battery (Tudor) of 221 cells and capacity to meet the demand after 11 p.m. and on Sundays. In 1911 a twin-cylinder horizontal type engine of 250 B.H.P., with generator, was installed, with two separate sets of producer gas plant for use with coke. In 1914 the demand for electricity had increased to an extent that required more generating plant. A much larger unit of plant was now installed—a vertical engine of 600 B.H.P. with eight cylinders, together with two sets of producer plant of ample capacity. A cooling tower was erected with duplicate centrifugal pumps, motor-driven. With an arrangement of underground and overhead water tanks and pumps the water required for the producers is circulated through the scrubbers over and over again, it being only necessary that the water be cooled sufficiently. The scrubbers while fed with a constant supply of water do duty chiefly in cooling the gas, there being no impurities to absorb except sulphur gases. When some qualities of anthracite are used in the producers, or gas coke from horizontal retorts, very great care must be taken to clean the gas thoroughly from traces of tar. With the use of vertical-retort coke, however, all tar troubles immediately cease, the volatile matter in this coke being practically nil.

The supply is on the three-wire system, 220 volts for lighting and 440 volts for power. Since 1914 the output of current has rapidly increased, and at the present time a 700-B.H.P. vertical engine and generator are in process of erection, on the same lines as that already described.

The increase in the output of energy is shown in the following statement:—

Consumption of Electricity.

Year.	Private Lighting.	Power.	Public Lighting.	Total.	Max. load on feeders. KW.
1911 ...	55,460	13,922	28,938	98,320	85.0
1912 ...	59,145	92,015	27,397	78,557	105.6
1914 ...	88,037	247,060	24,845	360,942	229.0
1916 ...	135,821	642,347	11,794	780,963	440.0

It will be observed that the greatest increase has been for power purposes, and this has had a very important influence on the working results and success of the station.

Regarding cost of production, the following statement gives the working results for the past year:—

	Amount.	Pence per unit sold.
Fuel	£767 0 2	0.23
Oil, waste, water, &c.	363 11 10	0.11
Wages of workmen	951 10 5	0.29
Repairs and maintenance	432 4 9	0.13
Rents, rates, taxes	114 8 9	0.04
Management, office, and legal expenses	159 6 8	0.05
Insurance of plant	187 11 1	0.05
Total	£2,975 13 8	0.90

The price charged for coke was 13s. per ton.

For stations of the size of Alloa, gas-engine driven generators and producer gas plant undoubtedly provide low works costs, and our experience has amply proved the wisdom of the choice of plant.

The prices charged to consumers are for lighting, 4d. per unit; for power, from 2d. to 0.8d. per unit. An extra 15 per cent. on power and 5 per cent. on lighting will be charged until further notice.

Financial Results.

Revenue—	
From private lighting	£1,988
From power and heating	2,832
From public lighting	123
Rents, royalties, &c.	13
Total	£4,956
Working costs	2,976
Gross profit	£1,980
Gross profits—	
Before providing for interest, &c.	£1,949
Per cent. to capital outlay	5.96
Interest	949
Sinking fund	987
Surplus	44

In using coke as the fuel for the production of electricity a product of the distillation of coal is being utilised, the raw coal having been consumed in the vertical retorts in a scientific manner, yielding a satisfactory heating gas for industrial and domestic needs, as well as a smokeless solid fuel, and the other valuable by-products, tar and ammonia. This aspect of the generation of electricity from gas engines with producer gas made from gas-works coke as the fuel is of extraordinary importance from a national standpoint, having regard to the wasteful use of coal direct for electricity generation. The combination of gas and electricity production in the manner outlined is a singularly good example of realising in a highly economical way the value of coal.

The producer plant in use at Alloa is of the suction type, and therefore the nitrogen value of the coke has not been recovered as ammonia. The installation has been too small to warrant the capital expenditure for recovery plant, but with the horse-power of engines now installed a scheme for producer gas plant on the Mond type with recovery plant has been determined upon. Conditions of war have prevented the expenditure of money on new plant, and the installation has therefore been delayed in erection. The conception of the scheme is as follows:—Coke contains about 1 per cent. of nitrogen, and the results of experiment on the large scale have shown a yield of 30-40 lb. sulphate per ton. The Mond plant will be erected on the gas works site, and a supply of producer gas will be afforded to the gas works for heating the retorts, and to the electricity station for driving the gas engines. The gas works are already equipped with plant for the manufacture of sulphate, and this plant will in part be available.

The strongest evidence I can bring to prove that electricity has a permanent place in public demand coincident with a large consumption of gas, and that competition does not enter in to destroy the interests of either department, is an example

of the gas and electricity supply of Alloa. For many years Alloa has enjoyed a low rate for gas for lighting and cooking, in pre-war times 2s. 1d. to 2s. 4d., and a specially low rate of 1s. 4d. to 1s. 10d. for power. Every facility has been given to consumers to take advantage of the use of gas, with the result that for a population in the area of supply of 17,200, the gas manufactured per annum is equal to 150,000,000 c.f., considerably higher per consumer than most towns in Scotland.

As regards the consumption of electricity, it will be noted that the annual output has increased from about 100,000 units in 1910 to about 800,000 units in 1916. The author is not conscious of any collision of interests in the supply of the two forms of energy—new consumers are not lost, as they are bound to come to us for supply—and is only concerned with the joint success of the two works forming one department of business. Consumers demand whatever form of energy is most convenient and best suited to their requirements, and they are supplied accordingly. A showroom was recently opened in which there is exhibited lighting, heating, and cooking apparatus for both gas and electricity.

The directors of a gas company in considering a scheme for electricity supply may reasonably conceive that by embarking upon an electricity scheme the consumption of gas will be lessened, and electricity take its place. Such a view is dangerously wrong. Of no area of gas supply can it be said at the present time that the use of gas has reached the utmost limit, and an increase in consumption for domestic use, as well as for industrial needs, should yield an increasing output from year to year. To embark on an electricity supply scheme would simply be pursuing the same line of business, but by a different avenue. Where electricity is available for lighting it will command a fair share of domestic use, while for public buildings and shops, preferment is given to electricity. Further, considering the adaptability of the electric motor, there will be a certain displacement of gas engines thereby, and for larger units of power electricity will be installed.

It will be perceived that with this view of things the advantages and gain will be with the company supplying the two kinds of energy. Provided the area concerned is a suitable one, industrial to be preferred in order to obtain the highly valuable day load, the electricity side of the business can, in my opinion, be made remunerative if diligence is shown (1) in keeping down the capital account, (2) in selecting a type of plant the working of which will be conjoint with the interests of the gas works, (3) that the gas works be selected as the site for the generating station, (4) to dissociate in practice any spirit of competition, and to push the sale of electricity as a legitimate and remunerative business. From the point of view of the interests of the public, it is not desirable that there should be a duplication of works supplying the one kind of commodity, though in two different forms, as the increased cost of production must fall on the consumer.

From the evidence now adduced it may be fairly claimed that the co-existence of gas and electricity supply under one control is at once a practical and commercial proposition. The fresh field of business will appeal chiefly in the case of towns where there is at present no electricity supply. It is my settled conviction that what is required of the gas industry of to-day is a broadening of the basis of its function as suppliers of the public need for energy—gas and electricity. There is small doubt but that gas companies, if they do not prepare the way, will be met in the near future with competition where there is no electricity supply at present. It is a true indication of strength and vitality when an industrial business can comprehend the issues that lie in front of it and, having done so, prepare accordingly.

Discussion.

The President, Mr. Alexander Masterton (Edinburgh), said he thought the author had made out quite a good case for gas authorities taking over the supply of electricity. The strongest argument, to his mind, was the economy which would be effected in regard to the use of coal as a result of the combination. The author's experience and the data he had given ought to be of considerable service and assistance to municipal authorities who were considering the problem of the supply of heat, light, and power. Placed under the jurisdiction of a capable engineer and manager—one without bias either towards gas or electricity—the joint management ought all to be in favour of economical working and the production of these two agents for supply to the public at cheap rates. There was no reason why the two competitors should not work side by side, promoting the interests of each other in the best possible way.

Mr. David Robertson (Dunoon) considered that there need be no rivalry between gas and electricity provided they were under the one control. He thought the author was proceeding on right lines when he suggested that gas companies or corporations ought to have the control of the electricity supply in any one district. If the electricity station was placed in the gas works there was absolutely no doubt but that economy would follow.

Mr. Clarke (Chesterfield) said he happened to be in the unique position of being chairman of a gas company manufacturing 220 million cu. ft. of gas, and vice-chairman of an electrical company with plant up to 2,500 kw. These two interests were antagonistic and conflicting, and as chairman of the gas company he was suspected of having leanings towards electricity and *vice versa*. The great point he desired to make as the outcome of his experience was that the two undertakings were quite separate and distinct, and a particular set of conditions appertained to each. He could see that the combination might be successful in small residential towns, but only there.

Mr. J. W. Napier said he had been most careful to point out in his paper that his conception of a joint scheme did not apply to towns of considerable size. In large centres, he frankly admitted that separate management was not only desirable but necessary. Taking a broad view of things, he was satisfied that for towns of a population up to about 20,000 an amalgamation of interests would prove beneficial.

MANCHESTER ELECTRIC VEHICLE TRIAL.

A most interesting report is that recently made by Mr. S. L. Pearce, chief engineer of the Manchester electricity department, to the Electricity Committee of that city, on the trial use of an electric vehicle in place of horse haulage in connection with the work of the department. The vehicle, a one-ton standard G.V. lurry, supplied by Messrs. Drake & Gorham, was fitted with an Edison battery and a 3-h.p. motor capable of 200 per cent. overload for short periods.

The trials were carried out by the testing department, under the direction of the superintendent, Mr. H. A. Ratcliff; the lurry has been employed in the service of the department since the end of March, 1916.

Mr. Pearce mentions that the report deals with the subject on the basis of the actual results obtained, and no attempt has been made to work up a case for the electric vehicle, and that, so far as personal considerations were concerned, he had been somewhat sceptical as to the possibility of an electric lurry being able to compete with existing contract carting arrangements, and also as to the claims made on behalf of the former.

1. *Horse Carting Conditions.*—Light lurries were ordered from the contractors as required by the several departments concerned, payment being on a flat rate on a time basis. As an equitable rate a figure of 1s. 4d. per hour has been taken for the purpose of comparison.

2. *Test Conditions.*—It was obvious that if the electric lurry was merely to replace and do the equivalent work of a horse lurry it would certainly not compare favourably, owing to the higher standing charges and the additional running costs. Consequently, it was necessary to reorganise the carting arrangements to a very considerable extent so as to give as nearly as possible continuous employment for the electric vehicle, and also whenever possible reduce the number of separate journeys by combining two or more departmental carting jobs in one round journey.

3. *Driving Arrangements.*—The employment of a special driver appeared to be undesirable; two fitter's labourers were therefore trained for the work. The driver's attendance is not always necessary, and he can therefore be employed on other work, thus reducing the standing charges considerably.

4. *Working Cost of Electric Lurry.*—The figures arrived at (on a liberal scale) are:—Standing charges, 1s. per hour; running costs, 2d. per mile; driver, 7d. per hour during the time he is actually employed with the lurry.

(a) *Standing Costs.*—The standing charges have been calculated on a basis of 2,500 working hours per annum, *i.e.*, 50 hours per week for 50 weeks in the year.

The "life" of the chassis and body has been taken at 10 years, and written down accordingly at 8¾ per cent. per annum.

The makers state that the battery will last for at least 10 years, or alternatively for 100,000 miles. The guarantee, however, is only for four years, and five years has been taken as a reasonably safe estimate of the working "life" of the battery, and it has been written down accordingly at 18¾ per cent. per annum.

The possible scrap value of the battery after five years' "life" has been ignored.

Interest on the full capital outlay has been allowed at 4½ per cent. The actual capital charges are therefore as follows:—

Outlay on chassis, £355, less 5 per cent.	...	£337	5 0
Outlay on battery, £280, less 5 per cent.	...	266	0 0
Outlay on body		45	0 0
Outlay on tires		25	0 0
Outlay on filler		2	10 0
		675	15 0
4½ per cent. on £675 15s.		30	8 2
8¾ per cent. on £384 15s.		33	13 4
18¾ per cent. on £266		49	17 6
		113	19 0
Insurance		10	0 0
Two drivers' licences at 5s. each		10	0
		£124	9 0

£124 9s./2,500 = 11.95d., or, say 1s., per hour on a basis of 2,500 hours per annum.

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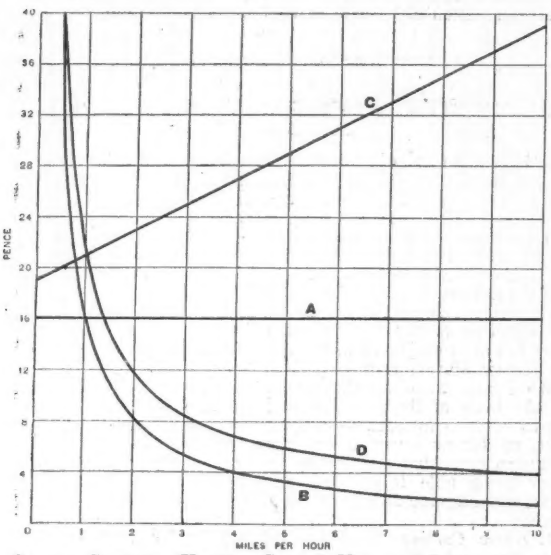
If the interest rate be taken at 5 per cent. the figure becomes 12.27d. In addition there is the wages of the driver at 7d. per hour, but this is hardly a true standing charge for the reasons given above.

(b) *Running Costs.*—The load is an "off peak" one, and does not cost more than one-third of a penny per unit, but in order to cover small incidental expenses the cost of current is taken at one halfpenny per unit.

The vehicle normally requires about 6.5 ampere-hours per mile, which corresponds to about 0.7 KW.-hour per mile; but



Curves Showing Vehicle Costs: Horse, A per hour, B per mile; Electric, C per hour, D per mile.

as the efficiency of the motor-generator used for charging the vehicle is only about 70 per cent., the actual consumption per mile is approximately one KW.-hour.

The cost of tires has been based on a "life" of 12,000 miles, and repairs and upkeep of vehicle and battery have been taken at 1d. per mile, which is well in excess of the makers' allowance of 0.6d. per mile.

Tires: 12,000 miles at £25 the set = 25 × 240/12,000 = 0.5d. per mile.

Total running costs per mile:—Current at ½d. per unit, 0.5d.; tires, 0.5d.; repairs and upkeep, 1.0d.; total 2.0d.

5. Comparison of Costs.—From the above results the accompanying curves have been drawn, and they enable the relative costs for any condition of speed to be seen at a glance. The curves show:—

A. The cost per hour for horse lurry and driver.

B. The cost per mile for horse lurry and driver.

C. The cost per hour for electric lurry and driver.

D. The cost per mile for electric lurry and driver.

All the curves have been drawn to a common base of "miles per hour."

The two most noticeable features are:—(*a*) The cost of the horse lurry per hour is naturally independent of the mileage; (*b*) the standing cost of the electric is only 3d. more than for the horse lurry, and is actually 4d. less if the driver is not in attendance.

Obviously comparable results can only be obtained by getting more work out of the electric in the same time, *i.e.*, by increasing the average miles per hour.

It has been found that two miles per hour is an average figure for an ordinary horse lurry. For the ordinary carting day of nine hours this gives an average daily mileage of 18, which is a very reasonable estimate.

Before these trials were conducted Mr. Pearce was of the opinion that an electric lurry would only be worth consideration if it could be shown to be capable of doing the work of one and a half horse lurries; actual operating data covering a period of four weeks ending May 6th, 1916, plainly shows that the electric lurry is the equivalent of at least one and a half horse lurries, work for work, both on the total average daily mileage and also on the average miles per hour.

Referring to the curves, it is seen that at two miles per hour the horse lurry costs 8d. per mile, and a horizontal line drawn through this point cuts the electric curve at 3.16 miles per hour; a condition which the tests have proved to be practically fulfilled.

Owing to the organising of the carting rendered possible by the use of a mechanical vehicle, each journey undertaken has represented the carting of 1.6 departments, and therefore the total work done by the electric is the equivalent of that done by 1.5 × 1.6 = 2.4, or, say, two horse lurries.

The average cost works out at 7.65d. per mile (instead of 8d.), or 188.1 × 7.65d. = £6 per week.

Calculating on a basis of two miles per hour for the horse lurries, data shows that the electric is the equivalent of 3.37/2 × 1.61 = 2.71, or, say, 2½ horse lurries.

The electric lurry is variously estimated as the equivalent of from two to three horse lurries, with a preponderance of opinion in support of the higher value.

For 58 hours during the four weeks ending June 3rd, 1916, or an average of 14.5 per week, the driver was actually working as a motor fixer's labourer. This represents a saving on the driving item of 14.5 × 7d. = 8s. 5d.

The net cost of the carting is therefore £6 − 8s. 5d. = £5 11s. 7d. for 188.1 miles, or 7.12d. per mile.

Assuming the electric to be the equivalent of 2½ horse lurries, the amount saved per week is 2.5 × £3 6s. 8d. − £6 = £2 6s. 8d. (The figure of £3 6s. 8d. represents 50 working hours at 1s. 4d. per hour.)

This calculation makes no allowance for possible reduction in actual driving time. The amount saved in a year of 50 working weeks will therefore be £116 13s. 4d., or nearly sufficient to cover the capital charges on the electric lurry.

6. Total Cost of all Carting (1916).—January £150 4s. 8d., February £131 1s., March £158 8s. 2d., April £109 4s. 3d., May £110 16s. 11d.

Owing to the weather conditions there was a marked reduction in all the carting during the month of February. It is therefore permissible to regard the mean of the January and March costs as a reasonable average value.

The Easter holidays would reduce to some extent the total carting for the month of April, and to allow for this the actual cost is increased by £6.

Average cost per month for January and March	£154	6	5
Average cost per month for April and May ...	113	0	7
Actual reduction due to the operation of the electric lurry	41	5	10
Average cost per month of electric lurry	26	0	0
Amount saved by electric lurry per month ...	15	5	10

Taking the weekly cost of a horse lurry as 75s., *i.e.*, 50 hours at 1s. 6d. per hour, or, say, £16 6s. per month, and the electric lurry as the equivalent of 2½ horse lurries, then the reduction of the carting account *should be*:—£16 6s. × 2.5 = £40 15s.

This estimated figure agrees very closely with the actual reduction obtained as above.

Were it not for the unduly inflated price of electric vehicles, and more particularly those fitted with Edison batteries, very much better working costs than those given above could be obtained.

Standard G.V. Lurry, Manchester Electricity Department.

7. Speed.—The first impression of the speed is that it is very low, and it is undoubtedly lower on the average than the makers claim. As the bulk of our carting is in the city area, however, it is at least questionable whether a higher average speed would be much of an advantage. On hills there is certainly room for improvement, but this could only be obtained at the expense of a larger battery and an unnecessarily high and undesirable speed on the level.

The very low speed on hills is the natural result of the characteristic speed torque curve of the series motor, and is further accentuated by the comparatively high internal resist-

ance of the Edison battery. Probably this is one reason why lead batteries are frequently preferred for vehicle work, although personally Mr. Pearce considers that any gain in this respect is more than counter-balanced by the objections attaching to the use of sulphuric acid on vehicles.

The average speed is higher than can be maintained by a horse, and on the level is probably as good as that obtained with a steam lurry; but although better than a horse it cannot equal a petrol vehicle on hills.

On average roads and with average loads the average speed is about 9 to 11 miles per hour, and may under exceptional conditions reach 12 miles per hour. On hilly roads the average speed is 7 to 9 miles per hour, but less if the hills are exceptionally steep.

On a recent trial run 16 miles per hour was obtained on a down grade in Middleton Road, but the road was clear and there were no side roads.

The apparently low speed has not prevented the obtaining of an average of 30 miles per day, and a maximum on one occasion of 50 miles in the day.

It is questionable whether the railway companies' petrol-driven parcels vans average more than 35 miles per day.

As a result of these extended trials, Mr. Pearce recommended the Committee to retain the electric vehicle, stating that he had little doubt, in the light of the experience gained, that electric lurries could be advantageously used for other branches of the department's carting work in preference to horse-drawn vehicles.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Large Impulse Turbines.

Messrs. Fraser & Chalmers, Ltd., of Erith, who, since 1905, have been developing the horizontal multi-stage impulse turbine, recently supplied to the South Metropolitan Electric Light and Power Co., Ltd., the turbine illustrated in fig. 1, driving a 6,300-kw. alternator at 3,000 r.p.m. The large clearances permissible in this type of turbine, and the diminished axial thrust, rendering a balancing piston unnecessary, are amongst the chief reasons for preferring the impulse to the reaction principle; the small number of stages and consequent short length of the machine are additional advantages, the latest type of Fraser & Chalmers turbine having one velocity wheel with two rows of moving blades at the first high-pressure stage, and a number of single impulse stages for the rest of the expansion. The turbine interior is also subject to lower temperatures and pressures and possesses close governing characteristics. Nickel steel is used for the blades, which are milled out of square bars together with the fork by which they are fixed to the moving wheel; the method of securing the blades is shown in fig. 2, the velocity wheel being provided with similar blades to those of the single wheels. The design of the turbines has been standardised, and special machinery has been installed for their exclusive production. A small-power impulse turbine of the multi-velocity stage impulse type is also made.

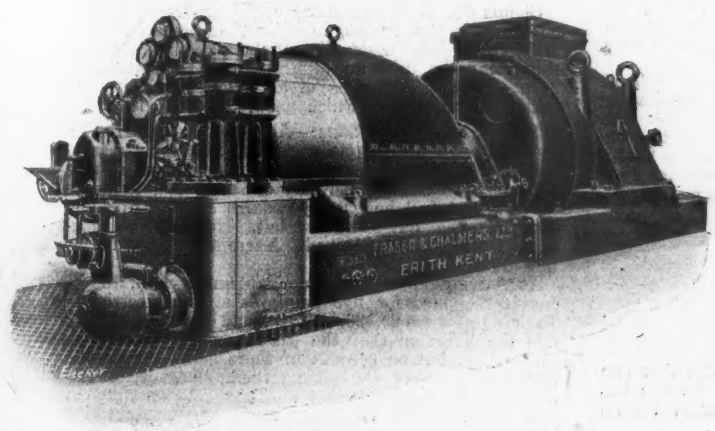
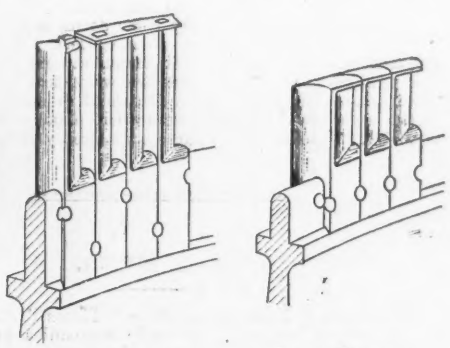


Fig. 1.—Fraser & Chalmers Turbine driving 6,300-kw. Alternator.



Long Blades. Short Blades.

Fig. 2.—Blading of Fraser & Chalmers Turbine.

A High-Efficiency Carbon Lamp.

The *Electrical World* describes a new patent gas-filled carbon-filament lamp of German origin, which is said to have an efficiency even higher than that of metal-filament lamps. The bulb is filled at the start with an indifferent gas at a pressure slightly below that of the atmosphere. The filament is of the concentrated helical type, and is supported just above a pool of mercury, which is evaporated by the heat when the circuit is closed. A glass tube surrounding the filament and its supporting conductors and dipping into the mercury forms an inner chamber in which the mercury vapour rises, pushing the inert gas upwards and away from the filament; apertures at the top of the chamber permit the gas to escape into the outer space and equalise the pressure on the mercury, while the outer wall of the bulb remains cool and can therefore withstand the comparatively high pressure. One form of the lamp is illustrated herewith.

Fig. 3.—Gas-filled Carbon-filament Lamp.

NOTES FROM CANADA.

[From our Special Correspondent.]

For the second time the great Quebec bridge has met with disaster.

A few generations ago it would have been said that the Spirit of the great river was determined that the waters should not be spanned by man, and probably the attempt would have been abandoned. To-day we are more prosaic, and doubtless work on a new centre span will be proceeded with almost immediately. One sympathises with the engineers, whose labours of several years were about to be brought to a successful conclusion, and who must now be so bitterly disappointed.

It is just a few weeks over nine years since the first attempt at building the bridge failed; at that time 63 men lost their lives. On this second occasion, fortunately, only 13 men were killed, though this is bad enough.

So far, the two bridges have cost about £5,000,000, and yet the river is not spanned.

It is observed that the Council of the I.E.E. advocate the adoption of British standards throughout the British Empire. This would be a great and worthy object to work for, but the Council may be assured that whatever might be accomplished in other of the Dominions, such as South Africa and Australia, it would be no easy task to deal with Canada in this respect, as the influence of the U.S. (already very strongly established so far as standards are concerned) would be almost impossible to counteract.

As has been pointed out in these notes before, too many Canadian engineers get their engineering education and training in the U.S. for British standards and methods to obtain much of a footing here. What is needed is the training of Canadian engineer students in the British Isles, so that they will come back home with a knowledge of British methods and British firms instead of, as is often the case at present, a knowledge of U.S. methods, &c., and a supreme contempt for "old country" ideas.

It is not enough, either, that large numbers of engineers should come from England; the young men born in this country must be given an opportunity to receive their engineering training in

British workshops and to return knowing the capabilities of the engineers there, the methods in vogue, &c., before much can be done in getting British standards adopted here.

U.S. standards and specifications prevail here in connection with the following among other items :—Cast-iron water mains, structural steel, Portland cement, wrought-iron pipe, screw threads, pipe flanges, electrical conductors, temperature rise and insulation tests for electric motors, transformers, &c. To what extent these prevail may be judged by the Trade Returns of Canada in engineering materials, &c., the ratio of U.S. to British imports being, in normal times, about 7 to 1; at present the disparity is probably much greater.

In Saskatchewan the Government (Provincial) is investigating the possibility of developing the water power of the rivers in the north of the Province for the benefit of the towns and villages there. It is argued in some quarters, however, that utilisation of the great lignite fields, and even of the immense quantities of the straw produced each year on the farms, would be a better and cheaper method of obtaining power than using the available water power, owing to the cost of development and the long transmission lines necessary in this last case.

The Dominion Government is reported to have appointed a Commission to investigate the subject of generating some 2,000,000 H.P. on the Niagara River below the Falls. The scheme under consideration was given publicity some time ago, and involved the building of a dam in the rapids whereby the water level would be raised 100 ft.

The Canadian Niagara Power Co. is installing three more 12,500-H.P. units at Niagara Falls, making the total capacity of the station 112,500 H.P.

In the City of Montreal the Board of Control has before it a scheme of hydro-electric development in connection with an enlarged aqueduct. A number of prominent engineers consider the proposals to be unwise, and have requested that the Board have an independent investigation made; the Board have, however, recently refused this.

The Hydro-Electric Power Commission of Ontario had a rather serious shut-down on its system not long ago. One of the large oil switches at the Dundas inter-switching station (where the main supply of power comes in from Niagara Falls, and is distributed at Dundas to the various main transmission lines) caught fire and caused serious damage, interrupting the supply over the whole of the Niagara system, covering an area not much smaller than England, for several hours. A somewhat similar, but less serious, accident occurred shortly afterwards at the generating station at Niagara Falls.

The Germans are reported to have been trying to obtain a substitute for switch and transformer oil, presumably because oil is growing scarce in that country. The accidents referred to above, furnish a very good reason why in Canada and other parts of the world a less inflammable insulating liquid should be found as soon as possible. Carbon tetrachloride does not yet appear to be a satisfactory substitute for a good switch oil.

As rates for current steadily come down, as they are doing in Ontario, there will be an ever-widening field for electric heating and cooking appliances. English manufacturers might look into the possibilities of supplying electric water-heaters to fit into the warm-water tanks which are a feature of so many of the houses in the larger towns and cities here where a public water supply is available. Heaters for this purpose are already on the market.

WAR ITEMS.

War Saving Certificates.—The "Times" states that one of the largest telegraph and cable companies in London has taken £100,000 worth of War Savings Certificates for its employés all over the world.

Enemy Goods Prohibited in New Zealand.—By Order in Council the importation of goods manufactured in the enemy's territory into New Zealand is prohibited.—*Times.*

The A.E.G. and Shipbuilding.—A further development proposed by the A.E.G. is reported in the German newspapers, which state that the company intends to embark upon the construction of oil-driven ships with Diesel engines. An option has been obtained from the State of Hamburg on a large site at the Finkenwerder, where an industrial works and shipyard are to be built either before the end of the war or directly afterwards. The company is said to be in close contact with shipowners on the matter, particularly the Hamburg-American Co.

Sub-station Lighting: Prosecution.—The Hull Police magistrates have fined Wm. Stevenson, night chargeman at the Corporation electric sub-station on the Prince's Dock side, £5 5s. for leaving five windows brightly illuminated at 1.55 a.m. on August 26th. A constable said that when he saw defendant he said that this always occurred when they were charging up. Defendant said that the windows were painted, and he was not aware that anything more than a subdued light was showing. The sub-station superintendent said that the windows were painted a dark amber colour in December last, and they had had no previous complaint. They could not use screens or blinds because of the acid gases in the atmosphere.

Controlled Establishments.—The number of establishments now controlled by the Ministry of Munitions is 4,319, 107 having been added since the last announcement.

Trading with the Enemy.—The "London Gazette" for September 29th contains a further list of persons and bodies in the Netherlands, Sweden, and other countries with whom trading is prohibited.

To be Wound Up.—The following companies have been ordered by the Board of Trade to be wound up :—

Selas Co., Ltd., Manchester, manufacturers of installations for lighting and heating. Controller: J. P. Garnett, 61, Brown Street, Manchester.

Feld Bros & Co., Ltd., London, E.C., manufacturers of electric wires. Controller: J. E. Percival, 6, Old Jewry, E.C.

Wages in Railway Shops.—Men employed in railway shops are asking for an advance of 10s. a week, and representatives of the craft workers were to meet in London on Wednesday to discuss the position. The application is to be considered at a conference of the railway companies. There are about 100,000 skilled and unskilled men affected.—*Daily Telegraph.*

Munitions First.—The Minister of Munitions has issued a notice requiring all persons, firms, and companies engaged in the manufacture of cranes, aerial ropeways, capstans, conveyors, grabs, elevators, hoists, lifts, runways, shear legs, transporters, travellers, or winches, whether operated by steam, electric, hydraulic, pneumatic, or hand power, not to carry out, without a permit issued under his authority, in any factory, workshop, or other premises, any work consisting of the manufacture, assembling, or erection of any of the above-mentioned articles except under :—

(*a*) Orders received from or in connection with work for the Admiralty or War Office.
(*b*) Orders of a value not exceeding £50 required for war work.
(*c*) Orders which have already been sanctioned by the Ministry of Munitions as Class "A" work.

Liquidation of Enemy Firms in East Africa.—The Colonial Office notify that the undermentioned firms are in process of liquidation :—

Hansing & Co., Mombasa, Zanzibar, &c.
Deutsche Englische Ost Afrika Kompagnie, Voi.
African Handels-Gesellschaft m.b.h., Mombasa and Zanzibar.
Westdeutsche Handels- & Plantagen-Gesellschaft, Mombasa.
Wm. Hintsman & Co., Mombasa.
Wm. O'Swald & Co., Mombasa, Zanzibar, &c.
Strathmann & Joachim, Mombasa.
Alois Schweiger & Co., Ltd., Mombasa.
George Goetze, Afrika Hotel, Mombasa.
Deutsche Ost Afrika Gesellschaft, Zanzibar.
Chas. A. Heyer & Co., Nairobi.
G. Denhardt & Co., Lamu.

Claims should be submitted by December 1st to the Liquidator of Enemy Aliens, Mombasa, accompanied by: (*a*) A declaration of the nationality of the claimant; (*b*) an affidavit supporting the debt and affirming that no satisfaction has been received; (*c*) copies of all invoices showing marks of packages and port to which goods were shipped.

Exemption Applications.—At the Shrewsbury Tribunal, the head of a firm of electricians applied for a man aged 23, single, who was employed in making tools and setting lathes for women. He was the only one they had to do that sort of work. Asked how many women he had working, applicant said two, but some had left. However, he should have more if this man remained. Exemption final for a month was granted.

At Accrington Tribunal, on September 29th, the electrical engineer applied for five employés at the electricity works. Their ages were 25, 39, 25, 41, and 27. Captain Harwood told the Tribunal that the cases came before the Advisory Committee, but on account of there being three young men under 30 years of age among them they declined to have anything to do with them. They felt strongly that the management of the electricity works ought to get older men. The engineer said there were good grounds for making all the applications. The first one, aged 25, had been in the Territorials, was sent out to Egypt, and was there until last April, when he became time-expired. Older men had been tried, but it was found they were physically unfit. Captain Harwood: What will happen if, as an M.P. is proposing, all young men up to 25 or 30, whatever they are doing, shall be called up? The Town Clerk: They will have to do without light and power in Accrington, that's all. Captain Harwood said perhaps they had no option but to give conditional exemption now, but the engineer would have to face the music when it began to play later on. Conditional exemption was granted to all the men.

The Huddersfield Tribunal gave three months' further exemption, conditional on remaining at his present work, to an electrical wireman, aged 31, single, who, on the recommendation of the Tribunal to get work of national importance, was now a munition volunteer worker at Immingham Docks.

Sheffield Tribunal has given conditional exemption to R. C. Smith (33), electrical engineer, appealed for by Messrs. Makin and Co., Ltd.; and until October 31st to E. G. Bradman (37), electrician, appealed for by Messrs. Stuart & Moore.

Epsom Rural Tribunal has granted two months' exemption to Ernest E. Johnson, electrician, of The Lodge, Ordsall.

At Aldershot, Mr. Burch, The Arcade, appealed for George Hubbert, electrical wireman and fitter. Captain Croxford asked if Mr. Burch had got any men back from the camp

shops, and he replied "No; they are asking me for more men." Two months were allowed.

Sheffield Tribunal has granted exemption until the end of the year to Mr. W. Johnston (35), electrical engineer.

At Bath, Mr. Geo. Hitchens appealed for the retention of F. J. Hitchens (38), electric fitter. The appeal was respited for a medical examination.

At Kingston-on-Thames, Mr. H. H. Biden (35), electrician, applying for renewed exemption, stated that he had lost his foreman and all his men, and could not replace them. As all his capital was in the business, he wished to hold it together until the close of the war. He was allowed final exemption until December 31st.

An electrician who appealed at Broadstairs stated that, although unfit for Army duties, he was passed by the Medical Board for service. The Tribunal decided that he should go before the Appeal Medical Board.

An electrical engineer who appealed at Kingston-on-Thames, stated that he had thrice been rejected on account of chronic acute deafness, but was now passed for service in Class C2. The Mayor asked if appellant was of any use in the Army, and Colonel Chapman replied in the affirmative, adding: "The qualifications for C2 are that a man should be able to walk to and from work a distance of five miles, and should be able to see and hear sufficient for ordinary purposes. The Tribunal allowed final exemption to October 1st only.

Mr. A. C. Edwards (37), electrical engineer, of Wedmore, appealed at Bromley (Kent) on personal and business grounds, and was allowed a delay of two months.

The Military appealed to the Bucks Tribunal against exemption allowed to Wilfrid Parmenter (28), electrician at the High Wycombe Electroscope Theatre. It appeared that the local tribunal granted the concession because respondent, passed by the Army Medical Board for home service, was very deaf. The appeal was allowed, and the exemption cancelled.

At Melton Mowbray, renewed exemption was sought by Mr. C. W. Wright for Jesse Atkin, electrician at Saxilbye Park. Mr. Wright explained that he was under legal obligation to supply an electrician to the mansion, and Atkin could not be replaced. As he was passed for home service, and was acting as a special constable, Atkin was given conditional exemption.

At Newton Abbot, the Urban Electric Supply Co. appealed for W. H. Carpenter, clerk and electrician, and P. G. Stephens and A. W. Prudence, electricians and wiremen. The manager, Mr. Smith, said that owing to the military requirements, they had to work day and night, and Carpenter was indispensable. Exemption was allowed to Stephens (reserved occupation) and Prudence (medically rejected), but the appeal for Carpenter was dismissed, he being 21 years of age and single. Mr. Smith said he should appeal.

At Aldershot, the Traction Co. appealed for Mr. A. E. Webster (31), secretary, regarded as indispensable to the carrying on of the concern. It was stated that Mr. Webster was the only one who had full knowledge of all the details relating to the financial interests of the company; he had control of the books, and had under him a clerical staff of 14, of whom 11 were females. Three previous exemptions had been given, and a further three months were allowed. The company also applied for an inspector, claimed as being in a certified occupation, but the Military and Tribunal dissented, and dismissed the appeal; and for three drivers, two of whom were given a final month, and the other a month for him to be badged or replaced.

Before the Chichester Tribunal, a junior wireman and a shift engineer and assistant fitter were appealed for by the Electric Light & Power Co. The engineer stated that the staff had been reduced to a minimum consistent with safety, and the wireman was the only skilled man left for the work he was doing, except the mains superintendent. If the Military could find substitutes they did not wish to retain any single men. The wireman was refused exemption, and the shift engineer was allowed three months.

A Chichester electrical engineer, appealing for his brother, stated that he was the only man left to carry on the business. The Chairman said that they could not exempt single men of 21, and 14 days' exemption would be granted, with no further appeal without leave.

At West Ham, H. E. Wright (36), a Corporation tramway conductor, who appealed, said that he was the patentee and maker of a tram and 'bus ticket holder. It was agreed that the holder was a very handy thing, but the appeal was refused, and the calling-up delayed for three weeks.

At the Aberdeen Tribunal, H. W. Munro, electrician and overhead lineman, was claimed by the Aberdeen Corporation Tramways. Mr. R. S. Pilcher, tramway manager, stated that Munro, who had been passed for general service, was a skilled worker in a public utility service. There were three overhead linesmen. There were only seven exemptions in the department out of a staff of 302. Seventy-five per cent. of the staff were serving. Temporary exemption of two months was allowed.

Kidderminster Tribunal has granted three months each to Mr. W. H. Hughes, electrical engineer, and to E. Turner, tramway car shed foreman; and has respited for a medical examination an appeal by Thomas Barth, wireman and electrical fitter.

Llanelly Tribunal have granted two months' exemption to the electrician employed at Haggar's Theatre.

At Shrewsbury, Mr. Smallwood, electrical engineer, appealed for George W. Browning (22), wireman, the last one left out of the staff of 14. Exemption was granted until December 1st.

At Stroud (Glos.), the Electric Light Co. sought exemption for several men, and the Military Representative agreed that the company had done the very best they could to meet the military authorities. He thought that matters would be met by releasing the married men and taking the single ones. The company had suggested that the men claimed might be replaced by incapacitated soldiers; four such men had been provided, and they had useful careers before them. Several of the men were put back until the end of the year, and others until March 31st.

Contraband of War.—The following are in the additions to the list of articles to be treated as absolute contraband:—

Insulating materials, raw and manufactured.
Cadmium, cadmium alloys, and cadmium ore.

Books for Prisoners of War.—The needs of the British Prisoners of War Book Scheme (Educational) for the ensuing week are:—Works on transformers (Still), alternating currents (Still), alternating currents (Siemens), "Text-book of Electrical Engineering" (Thomälen), "Electrical Handbook" (Trautwine), "Steam Electrical Hand-book" (I.E.E.), "Modern Electrical Practice" (Gresham Publishing Co.), "Hand-book of Electricity," "Electrical Engineering" (Slingo & Brooker). Will readers please address offers of new or second-hand copies of books to Mr. A. T. Davies at the Board of Education, Whitehall, London, S.W., from whom further information respecting the working of the scheme can be obtained on application?

Disabled Sailors and Soldiers and Electrical Work.—The classes organised at the Northampton Polytechnic Institute by the Institution of Electrical Engineers, in co-operation with the London County Council, for the purpose of giving a preliminary training to disabled sailors and soldiers as electricity sub-station attendants are about to be resumed. Up to the present some 40 men have been admitted to the courses, of whom 25 have been placed in electricity supply undertakings, the remainder having either found other situations or been unable to complete their course. The courses are free to the men, and the work consists of demonstrations and exercises in the first principles of electrical engineering and of physics, practical work in the electrical and physical laboratories, and demonstrations in the power-house of the Northampton Institute. By the courtesy of some of the London supply companies visits are also paid in the last week of the course to sub-stations and generating stations in the London district, and instruction is given by the men in actual charge of the stations. A third batch of 20 men will begin their course about the middle of October, and will be ready to take up employment as probationers about the middle of November. Engineers having vacancies which could be offered to these men are requested to communicate with Dr. Walmsley, Principal of the Northampton Polytechnic Institute, Clerkenwell, London, E.C., who will also be pleased to send application forms for admission to the courses, with full particulars, to disabled sailors or soldiers wishing to join.

Exports to China and Siam.—The "London Gazette" for October 3rd contains further names of persons and bodies to whom or which exports to China and Siam may be consigned.

BUSINESS NOTES.

Greece.—According to the U.S. Consul at Patras, commercial and industrial conditions in Western Greece were, upon the whole, satisfactory during 1915. He goes on to show how beneficially the war has affected importation from America, both volume and variety having greatly increased. Prior to the war, the imports from the States were not more than £20,000 per annum, but during 1915 the value for articles in which the Consulate lent direct assistance alone was £749,200, so that the total far exceeded that figure. The great bulk consisted of wheat and other food supplies. The Consul says it is practically certain that when peace is restored a large part of the trade now done by American exporters will revert to the original sources of supply. Metal manufactures are mentioned as one of the fields in which there will probably be sharpest competition, and in which the American exporter will have the best prospect of holding his ground. A suggestion is made in regard to the question of credit:—"If possible, the American exporter should make some concessions as to terms. This market was formerly accustomed to credits of from two to six months. It is doubtful whether such credits were necessary, as was maintained by many importers. The fact that importers have, during the war, been able to do an abnormally large business (in certain lines particularly) on the basis of 'cash against documents port of shipment' seems to indicate that local importers can do a cash business if necessary. It is hardly probable that this market could be persuaded to continue its 'cash against documents port of shipment' business with America in face of credits that will doubtless be offered again by European markets upon the termination of the war. Several firms have expressed a desire to continue their business with American markets after the

war, provided the American exporter is willing to deal on a basis of 'cash against documents port of destination'; which would be equal, from the seller's standpoint, to something like 30 days cash. The local importers have begun to discover that the American method of doing business on a practically cash basis has certain decided advantages to the buyer, and that the long-credit terms offered in the past by other markets have generally been balanced by higher prices."

The U.S. Consul at Salonika also refers to the same subject in the following terms:—"The great difficulties which affected American trade during the past year were insufficiency of transportation facilities, excessive freight rates, the non-delivery of cables, and disorganised banking facilities. Under normal conditions, European terms of sale are generally more favourable as regards credit than those of American firms. However, price and quality are more important factors than credit. It is reasonable to believe that long credit is not given without making provision for interest and a percentage for possible loss. It is difficult for American firms, who have no representatives in the Balkans, to ascertain the financial standing of local firms, as no commercial rating agencies have branches in Salonika. It is believed, however, that local banks would answer credit inquiries from American banks more readily and completely than inquiries coming directly from American manufacturers or exporters. As of possible interest in this direction, the names of the following local banks are submitted:—Banque d'Orient, Banque Nationale de Grece, Banque Impériale Ottoman, Banque de Salonique, Banque d'Athènes, and Banque de Commerce et Dépots."

China.—The U.S. Consul at Harbin refers to the foundation of the decided success of Japan in Northern Manchuria that was laid by the Russian Government and by the Russian Chambers of Commerce. "Every encouragement to trade between the two countries has been given by the two Governments. The Russian Government placed enormous orders with Japan, and the Chambers of Commerce of various cities of Russia sent to the municipal administrations and to the banks lists of the various kinds of goods that Japan could profitably export to Russia as well as those that Russia could supply in return."

In the list of goods offered to Russia by Japan are the following:—Aluminium and manufactures thereof; electric bulbs; electrical machinery and fixtures; enamelled ware; earthenware; machinery and equipment for technical purposes; wire. Plans were worked out by the Japanese railways and by the Russian Imperial Ministry of Communications for the organisation of special exhibition trains to tour in Manchuria and Mongolia, but this scheme has not yet been put into effect. There was a great influx of Japanese merchants and small shopkeepers into Harbin during the last half of 1915, and it is said that every firm of any standing in Japan now has its agents there, and they have opened branches for the accommodation of the buyers from Russia. It has thus been the firm policy of the Japanese to make Harbin and not Dairen or Vladivostok or Moscow the distributing centre for all trade between the two countries. The Consul tells American manufacturers that under present conditions at least they must meet with very great obstacles in the competition for the trade of Northern Manchuria. Yet never before has so much American interest been shown in this trade, nor have such serious and intelligent efforts been made to secure a part of it. At least three large organisations of capital had decided by the end of 1915, or early in 1916, to station agents of American nationality, or to open branches, in Harbin. "These plans look beyond the present trade to the promise of the future." It is believed that a certain American banking house will open a branch in Harbin.

The Consul at Mukden says that previous to the war there was keen competition between German and Japanese importers of cheap articles for sale to Chinese. Since German goods have ceased to be obtainable in the market this line of trade has fallen entirely into the hands of the Japanese. He adds that the most hopeful direction in which American manufacturers may look to overtake their European competitors would seem to be in the supply of electrical railway and mining materials, and iron and steel manufactures, and perhaps, at the end of the war, in that of arms and munitions.

Copper Prices.—THE WEEK'S CHANGES.

Messrs. F. Smith & Co. report: Wednesday, October 4th:—Electrolytic bars rose from £138 to £140; ditto sheets from £156 to £160; ditto rods from £146 to £148; ditto H.C. wire from 1s. 5½d. to 1s. 5⅝d.; silicium bronze wire from 1s. 8¾d. to 1s. 9d.

Messrs. James & Shakespeare report: Wednesday, October 4th:—Copper bars, sheets and rods (best selected) rose from £157 to £164.

Dissolution.—GILBERT, FIELD & CO., cycle and electrical engineers, Station Street, Burton-on-Trent.—Messrs. W. C. Gilbert, F. Rogers, and E. J. Field have dissolved partnership, Mr. W. C. Field retiring. The remaining partners will attend to debts, &c.

Trade with our Allies.—Sir Algernon Firth, President of the Association of Chambers of Commerce, addressing commercial men at Wolverhampton, last week, said aliens should not be allowed membership of the British Chambers of Commerce, and the British Consular Service should be served by British. Dealing specially with trade after the war, he urged merchants and manufacturers to recognise the importance of the Russian and Italian markets. Two immense opportunities were waiting to be grasped. In 1913, of Russian imports 47 per cent. was done by Germany and Austria. It was our duty and interest to enable Russia to wipe these clean off the slate. In Italy the Germans had exploited the markets unscrupulously, and now that the connection with Germany was cut off, we ought to establish cordial business relations with Italy, even if the efforts did not secure an immediate return.—*Daily Telegraph.*

Book Notices.—*Applied Mechanics.* Vol. I. By Andrew Jamieson. Revised by E. S. Andrews. London: Chas. Griffin & Co., Ltd. Price 6s. net.—In spite of the depletion of our technical colleges by the war, the demand for the text-books of the late Prof. Jamieson has necessitated the issue of this, the tenth, edition of his well-known work. It has been revised by Mr. Andrews with a tender hand, avoiding any departure from the methods of the author, and the latest papers set in the A.M.Inst.C.E. examinations have been added. So successful a manual needs no commendation other than its own record.

The Fan By C. H. Innes. Revised by W. M. Wallace and F. R. Jolley. London: Technical Publishing Co., Ltd. Price 8s. 6d. net.—This is the second edition of a work first issued 12 years ago; it has been thoroughly revised and checked, most of the figures have been redrawn, and a new chapter has been added on recent practice in the construction of fans and centrifugal compressors. The connection between the fan and the electric motor is growing ever closer and more intimate; the load is ideal in many respects, and consequently the fan may reasonably be annexed as rightly belonging to the electrical field. There is probably no department of study in which greater progress has been made in recent years than in that which concerns the behaviour of air when solid bodies are moved through it at high velocities, and remarkable results have been obtained, which should be of use to the designer of fans on scientific lines. In this work the author applies to the subject the theory of the centrifugal pump, on the basis that in practice the compression of the air is so slight that it may be regarded as, like water, an incompressible fluid, and the examples of actual tests which he adduces certainly support this contention. Fans of many types are dealt with in detail, and the book can hardly be dispensed with by engineers engaged in designing or selecting fans and centrifugal air compressors.

Lektrik Tumbler Switch Controls for Glow-lamp Circuits.—Messrs. A. P. Lundberg and Sons have issued a booklet describing, with eloquent diagrams, the advantages and modes of application of some of the many controls detailed in their "Lektrik Lighting Connections," and showing the types of switches used, the purpose and effect of each device, and the number of wires required. The diagrams are of a novel kind, intended to assist contractors and others concerned in explaining the controls to their clients, and are therefore reduced to their simplest terms. The booklet, which is distributed gratis, should be very useful.

Catalogues and Lists.—MESSRS. I. FRANKENBURG AND SONS, LTD., of Greengate Rubber and Cable Works, Salford, Manchester, have sent us a copy of a small ring-hinge pocket memo. book with celluloid covers, such as they will forward to anybody in the electrical trade on application.

IGRANIC ELECTRIC CO., LTD., 147, Queen Victoria Street, London, E.C.—Leaflet No. 520, giving a full and illustrated description of their push-button control system for motor-driven planers and vertical slotters.

MESSRS. WAILES DOVE BITUMASTIC, LTD., 5, St. Nicholas Buildings, Newcastle-on-Tyne.—32-page pamphlet, containing particulars of their "Bitumastic" (brand) solution, testimonials concerning its protective qualities, and photographs of water tanks, pipe lines, gasholders, and other engineering works and structures coated with it.

MESSRS. LANDIS & GYR, LTD., 72, Windmill Road, Hampton Hill, Middlesex.—32-page illustrated catalogue of portable and switchboard patterns of their induction-type wattmeters.

British-Made.—According to the *Financier*, a member of the Southwark Borough Council last week gave notice of the following resolution:—"That, in order to promote and encourage in this country the development of industry and the manufacture of most classes of goods hitherto produced in enemy countries, it is necessary, in the opinion of this Council, that there shall be created an adequate demand, and that this demand can be assured by its being made obligatory on all Government departments and public and local authorities throughout the country to use, as far as possible, only British-made goods, and so create at once an open market sufficiently large to secure the economic interests of the various industries affected, and to urge forward the interests of technical education."

Mr. Stephen Walsh, M.P., a well-known Labour man, speaking at Wigan, said that after the horrible facts which the last two years had given us, surely it was the lesson of common sense to develop our own resources in our own land. "Why should we always make ourselves the dustheap and dunghill of the whole world? There were a thousand and one things which we could just as well produce in our own land, or in the Dominions affiliated with us, instead of being dependent upon the foreigner."

Bankruptcy Proceedings.—A. F. HAWDON, electrical engineer, Yetholm, Emfield Gardens, Gosforth, Northumberland.—October 14th is the last day for the receipt of proofs for dividend by Mr. C. Woollett, the trustee, 30, Mosley Street, Newcastle-on-Tyne.

Trade Announcement.—ROCHDALE ELECTRIC CO., LTD., have taken new showroom premises at 30A, Hare Hill Road, Littleborough.

South Africa.—The *Cape Times* stated in August:—"Electrical goods are arriving from the United Kingdom more freely now, but contracting work has not improved."

To Home Firms Trading with the Russian Far East.—H.M. Consul at Vladivostock (Mr. R. M. Hodgson) writes that his attention has been called to the fact that home firms, when telegraphing to firms at that port, not infrequently fail to give an adequate address to which replies should be sent. It should be noted that telegraphic or abbreviated addresses are not accepted by the Russian postal authorities, and that, consequently, it is impossible for the persons who receive such telegrams to answer them. Mr. Hodgson adds that local firms do not have telegraphic address lists, and it is therefore advisable that full addresses should be given to firms to whom senders of telegrams are unknown.—*Board of Trade Journal.*

LIGHTING AND POWER NOTES.

Abertillery.—Price Increase.—The Council has decided to increase the price of electricity by 1d. per unit.

Australia. — The Brunswick Council (Victoria) has decided to float a loan of £5,000 for the purpose of extending the electric lighting scheme.

The Narrabri (N.S.W.) Municipal Council will shortly take a plebiscite of the ratepayers on the question of borrowing £7,500 to finance an electric supply scheme for the town.

The South Australian Government proposes submitting to Parliament an amendment of the Adelaide Municipal Tramway Bill, so as to enable the Tramways Trust to supply power for electric lighting to its constituent Corporations and District Councils, and to private consumers.—*Tenders.*

Aylesbury.—The electrical engineer has reported that the Diesel engines have been successfully run on tar oil, and 5,200 gallons of the oil had been stored.

Bahia.—An American Consul reports that practically nothing was done throughout the past year in connection with the large hydro-electric plant under construction near Bahia.

Barnes.—At the meeting of the U.D.C., last week, the electrical engineer reported an application from the Barnes Mechanical Works for a further supply of 100 H.P.; it was necessary to lay a special cable to the premises at an estimated cost of £1,000. The Council decided to accede to the application, subject to the firm providing the capital for the necessary cable.

Bradford.—The local Press, in referring to the extension of the boiler house at the electricity works, mentions that the demand for electricity for the past half-year shows a bigger increase than in the previous 12 months, and that the supply to the spinning and weaving industries is rapidly growing.

Chester.—Hydro-Electric Plant.—When the Electricity Committee's proceedings came up for confirmation at the last meeting of the City Council it was stated that, at the request of the Ministry of Munitions, the work of adding a 12-in. curb to the weir, negotiations for which had been in progress several months, was now to be carried out. It is expected that this will result in a saving of 1,200 tons of coal a year.

Christchurch.—Electricity Prices.—With reference to the proposed increase of 10 per cent. on the contract price for electricity supplied by the Bournemouth and Poole Electric Supply Co., the B. of G. has offered to pay during the duration of the war an additional 5 per cent. on the electricity consumed, such additional payment to be the maximum, and to run from January 1st, 1916, to the end of the war, or for such lesser time as the company shall impose, the offer to be without prejudice to the terms of the contract.

Continental.—Spain.—Application has been made for a concession to utilise the water power of the River Inola at Salardu (Province of Lerida) in the generation of electrical energy for lighting and power purposes in the district.

Dewsbury.—Revised Charges.—The Electricity and Tramways Committee proposes the adoption of a new tariff for electricity supply to the Ravensthorpe district, under which the charges are to be 4d. per unit, plus 10 per cent., for lighting; for power, 2½d. per unit for one hour per day of the consumer's maximum demand, and a ½d. per unit for all energy used above that quantity, plus 15 per cent.; 2½ per cent. discount is allowed for prompt payment.

Doncaster.—Year's Working.—For the year ended March 31st, there was a deficiency of £263 on the electricity undertaking compared with a surplus in the previous year of £1,295.

Eastbourne.—Slot Meters.—The Electricity Committee has adopted a suggestion by the engineer with regard to the supply through slot meters (which before the increase in charges was at the rate of 6d. per unit, as compared with the ordinary flat rate of 5d., no meter rent being charged), that as it would be an expensive matter to alter the mechanism to adapt the meters for the increased price, a meter rent of 6s. per annum, or 1s. 6d. per quarter, be charged those consumers obtaining their supply through slot meters. During the past year, the engineer reported, the consumption by 79 slot meters was 5,032 units, an average of 63·7 units per meter, which, at a 1d. per unit, represented 5s. 4d. per annum.

Ebbw Vale.—Owing to the large number of new consumers there has been practically no decrease in the revenue of the U.D.C. electricity undertaking, and at present there is no necessity to increase the tariff rates.

Erith.—Proposed Loans.—The U.D.C. has decided to negotiate for loans of £1,300 and £4,000 for electricity purposes, these sums being unspent balances of sanctions by the L.G.B. in July, 1912.

Edinburgh.—Figures furnished by the Corporation Electric Lighting Department indicate a substantial reduction in the electric lighting as a result of the Summer Time Act. The decrease from May 21st last is 13 per cent. as compared with the corresponding period of last year. On the other hand, there has been a large increase in the amount of electricity required for power purposes, resulting in a total net increase of 8 per cent. in the amount of electricity supplied by the Corporation.

Falkirk.—Treasurer Gilchrist, moving the adoption of the Finance Committee's report on the estimates of income and expenditure for the year 1916-1917, stated that last year there was a loss in the electricity department of £156, and unless the price of electricity were raised there would be a loss again this year. It was therefore recommended that the cost of electricity for lighting be increased by 5 per cent. and for power by 10 per cent. This would mean an estimated additional income of £546, which would be sufficient to meet the expenditure of the department and leave a balance of £172.

Gravesend.—Sale of Plant.—The T.C. has accepted an offer from the Piggott Electrical Co. of £825 for the purchase of the No. 1 generating set, used as a stand-by, and not run for the past two or three years. It will be replaced after the war by a larger set.

Haslingden.—The Corporation has agreed to supply electricity to Messrs. J. Perritt & Sons' premises at Helmshore.

The Tramways and Electricity Committee has deferred consideration of the question of the department supplying electrical apparatus to consumers, pending inquiries from neighbouring authorities.

Hornsey.—The T.C. has made an arrangement with the Great Northern Railway Co. for the disposal of clinker and ashes from the electricity works, necessitating the construction of a gangway from the works to the siding, at an estimated cost of £15, and the Council is to make an annual payment of £1 to the company for the use of it.

Ilford.—Plant Extension.—A Special Committee of the U.D.C. reports that the electrical engineer has submitted preliminary tenders for the provision of main and sub-station plant, cable and conduits required in connection with the utilisation of the steam at the refuse destructor, for directly augmenting the supply of current to the eastern side of the district, instead of transmitting it in the first instance to the Ley Street works. Application is to be made to the L.G.B. for sanction of the borrowing of £10,000 for the necessary plant and building.

Kingston-on-Thames.—Year's Working.—The annual report on the Council's electricity undertaking to March 31st last shows a deficit of £629 on the year, as compared with a loss of £1,295 in 1915. The total receipts from the commencement of supply in 1893 have been £209,716,; the total expenditure on works cost excluding capital repayments, amounted to £129,492; and after repayment of principal and interest, there was a deficit on the full period of working of £18,745. The electrical engineer reports that the two horizontal Diesel engines had worked satisfactorily throughout the year, the fuel costs per unit generated being only ·464d., against 3·286d. per unit for coal for the steam plant. The chairman of the Electricity Committee stated that although the report was more favourable than the previous one, he was bound to draw the attention of the Council to what might be in store for it in the future. Daylight saving had made a great deal of difference to the revenue; in consequence of an accident to one of the Diesel engines, they would not be able to use it again until February or March, and the expenditure on coal, through having to use more steam, had gone up seriously. In additiou, there was the cost of the new crankshaft, about £1,000, which he anticipated would have to be paid out of revenue.

London.—Hammersmith.—The L.C.C. has sanctioned the borrowing of £650 for the purchase of a site for a sub-station. It is proposed that Messrs. Callenders carry out the cable work, at the cost of £628 in connection with the bulk supply to the Chiswick Electric Supply Corporation. In connection with the pumping of coal from the Council's wharf to the electricity works, arrangements have been made with the Port of London Authority for the use of the Thames water for this purpose.

Northampton.—Price Increase.—The local Electric Light and Power Co. has temporarily further advanced the price of current for lighting and heating by 10 per cent., and for power by 12½ per cent., as from the Michaelmas meter readings.

Preston. — Workhouse Lighting.—A new 55-kw. generating set, installed at Fulwood Workhouse, was formally started on Friday, last week, by the senior Lady Guardian.

Salford.—The Electricity Committee proposes to enter into an agreement with Messrs. F. Smith & Co. for the supply of current on certain conditions, including a minimum payment of £600 per annum.

Sunderland.—Plant Extension.—A scheme is under consideration of the Corporation for an important extension of the plant at Hylton Road. In his report to the Electricity and Lighting Committee, Mr. Blackman, the city electrical engineer, points out that the need for an immediate extension is shown by the fact that when the largest turbine broke down last year the works costs ran up in consequence by £3,500, and they were for the time without any stand-by. The demand upon the undertaking has grown during the last 12 months by about 830 kw., and new consumers would in the near future further increase the load. The extensions are estimated to cost £45,246.

Torquay.—Price Increase.—The T.C. has decided to increase the charge for electricity for private lighting by ½d. per unit from the Michaelmas reading of the meters. The Electricity Committee recommends that the question of the supply of electricity to the Tramway Co. consequent on the rise in the price of coal be reopened.

Twickenham.—The Council has declined to meet the proposed increased charges of the Twickenham and Teddington E.S. Co. on the ground that the price of energy for public lighting (which the Council interprets as lighting on its property) is limited by agreement to 2½d. per unit.

The Council has been recommended by its Committee to give the company six months' notice of termination of a licence for an overhead line, the company to remove the latter at the end of that period. This action apparently follows on a report by the surveyor that the overhead line had been renewed and added to without the consent of the Council.

Walthamstow.—The Lighting Committee has considered the report of the electrical engineer as to the result of the official tests carried out on the Ljungstrom turbine plant, and has instructed him to report further before finally taking over the plant at the expiration of the maintenance period.

Wednesbury.—Proposed Loan.—The T.C., on Monday, decided to apply to the L.G.B. for sanction to borrow £5,000 for electricity developments.

Wimbledon.—Price Increase.—The Electric Lighting Committee has resolved that, on and after the date of the next reading of the meters, the charges for supply to ordinary consumers of Wimbledon and Merton, and for the hire of meters be increased by a further 15 per cent., making a total increase of 25 per cent., and that the prices to be charged to ordinary consumers in Maldens and Coombe be increased to 6d. per unit for lighting purposes, and to 1½d. per unit for power, heating and cooking purposes, and that the charge for meter rents in the last-mentioned area be increased by 25 per cent. To secure more efficient working of the Curtis turbo-alternator, a new governor is to be fitted at a cost of £80.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation tramway men have applied for an increase of wages.

Australia.—In the report of the Chief Commissioner of the New South Wales Government tramways for the year ended June 30th, 1916, it is stated that the total output of electrical energy for the year was 94,352,417 kw.-hours, of which the alternating current gave 93,662,028 and the direct current 690,389 kw.-hours. On comparison with the previous year, the total output shows an increase of 797,858 kw.-hours, or 0·85 per cent. With regard to the new power house at White Bay, it is stated that six additional Babcock & Wilcox boilers, making eight in all, complete with economisers, fans, and chimneys, have been erected and put into service as required. Twenty miles of trolley wire on the City lines and 1¼ miles on the North Sydney lines have been renewed. Five miles of high-tension transmission cable have been erected between White Bay power house and Burwood sub-station. Nine miles of low-tension feeder cable have been erected overhead and 10½ miles laid underground on the City lines.

Barnsley.—The Barnsley and District Electric Traction Co. has reopened its motor-coach service between Barnsley, Goldthorpe, and Doncaster on Sundays, Mondays, Wednesdays and Saturdays only; the service includes parcel delivery.

Blackpool.—The lease of the tramway between the Grand Hotel and Squire's Gate, at present held by Lytham and St. Anne's Tramway Co., expires in July next, and as the Corporation proposes adding this to the routes under its own control, negotiations are in progress with a view to the Lytham and St. Anne's Co. having running powers over this section, as well as over that portion from the Central Station to the Grand Hotel.

Bradford.—Wages.—The Tramways Committee, on Monday night, gave further consideration to the application of the employés for another advance in wages, involving a revision of the entire scale of pay, and an extra cost to the city estimated at £21,000 per year, and decided to refer the question for settlement to the Committee on Production. The application affects over 1,000 employés, who want permanent advances varying from 5 to 15 per cent. in addition to the present war bonuses, which range from 3s. to 4s. per week. The increased cost of living is the ground of their demand.

Brighton.—Accident.—On Saturday last, a passenger accidentally struck a tramway gong during the temporary absence of the driver, and the conductress, thinking this was the signal to start, released the brakes, with the result that the car ran away down Queen's Road, eventually leaving the rails and colliding with a building. The passengers kept their seats and escaped injury.

Chester.—Track Renewal.—The city surveyor is to prepare a report and estimate of cost of relaying the tramway track where necessary, and the electrical engineer is to submit afterwards a detailed report and estimate of the cost of buying the tramway undertaking up to date, and of alternative methods of traction.

Doncaster.—Year's Working.—The surplus on the tramway undertaking for the year ended March 31st has fallen to £756 from £2,855.

Edinburgh.—Arbitration Proceedings.—Certain matters which are in dispute between the Tramway Committee and the Tramway Co. are to be submitted to Sir Alex. Kennedy, the arbiter under the lease, which expires in three years. The points of reference relate to the condition of the lines, and particularly to a very large section which the Committee had called upon the company to put in good order, a request which the company had refused. The proposed reference will, it is expected, clear the way for more rapid progress in the negotiations with the company on the whole question.

Glasgow.—A Corporation car, in charge of a woman driver, jumped the points in Dumbarton Road, shortly before midnight on Saturday last, and before it could be stopped, ran into a shop, one or two people being injured.

Hanwell.—At the meeting of the U.D.C., last week, it it was reported that the London United Tramway Co. proposed taking up the rails in Lower Boston Road for repairing purposes elsewhere, and had asked that this action should not be considered as an abandonment of the, at present, unused line. It was decided to assent to the proposal.

Ilford.—Vehicle Lights.—The tramway manager reports that the police authorities have now definitely decided to press tramways to carry out the new Lights on Vehicles Order to the fullest extent, and two white lights in front of the car, at the extreme corners, and one red light at the extreme off-side corner at the rear, have now to be shown. To carry this out he is fixing a considerable number of carriage lanterns purchased some time ago. In addition, he has found it necessary to buy twin-wire and special lamps and lampholders. The work will cost at least £50, and considerable alteration will have to be made to the wiring of the cars.

Leeds.—Accident.—Twenty-two persons were more or less injured in a collision between two cars on Wednesday night, last week, owing to one of them which, having got out of control near the Wortley terminus, ran down an incline and crashed into a car coming up a single line. The cars became interlocked and together ran down the hill, by good chance keeping the metals, until they ran off the line at the terminus, but fortunately did not overturn. Several passengers jumped off unhurt, and the driver of the runaway car was thrown off his platform without injury; only five persons had to be taken to the infirmary.

Leyton.—Vehicle Lights, &c.—The tramway manager has been authorised to alter the lights on cars to conform to the new lighting regulations. The cost is estimated at £55. The Great Eastern Railway Co. proposes to strengthen the approaches to the bridge carrying Lea Bridge Road over the railway, and as it is considered that the proposed work was rendered necessary owing to the cars on the tramway over the bridge, the Council has been asked if it will admit liability for payment of the expense to which the company will be put. The Legal and Parliamentary Committee of the Council is to report on this matter.

London.—North London Electrification.—The Broad Street to Richmond electric train service was brought into use on Sunday last; a saving of 10 minutes has been made on the old journey time.

South-Western Electrification.—The opening of the Waterloo to Claygate electric train service, which was to have taken place on Sunday, has been postponed.

Newport.—Collision.—Two cars came into collision on Saturday night, owing to a driver leaving a car, which started off uncontrolled. No passengers were hurt.

New Zealand.—In the railway statement for the year ended March 31st, 1916, presented by the Hon. W. H. Herries, Minister of Railways, it is shown that the particulars of expenditure on electric block working, telegraph and telephone facilities, and electric lighting for the year totalled £14,762 for new work; whilst maintenance was responsible for £15,857. During the year electric lighting has been installed at five additional stations, 10 railway dwellings, and in numerous buildings and goods yards. An electric engine-traverser was installed at Linwood, and the electrification of a 20-ton overhead crane in the boiler shop at Petone was also carried out. The installation of electric motors and transformers for Newmarket workshops is, it is added, in hand.

The Invercargill Municipal Tramway Department is increasing its power generating plant, which at times is fully loaded, and tenders are shortly to be invited for two additional boilers of 2,000 sq. ft. heating surface, and a 2,300-volt, 750-KW. turbo-alternator.

Northampton.—The B. of T. has extended to August, 1917, the period for the construction of the tramways authorised by the Northampton Corporation Act, 1911. The Tramways Committee has decided to inform the L.G.B. that it has no works which are likely to be carried out immediately on the termination of the war.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—January 22nd, 1917. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

October 17th. For the Deputy P.M.G. (1) Sleeves and tapes (Schedule No. 1,355), and (2) 3,100 stay-rods, with low tighteners (Schedule No. 1,359).*

MELBOURNE.—October 18th. Victorian Government Railways. Electric time releasing mechanisms for automatic signalling (Cont. No. 30,343).*—November 1st. 50,000 yellow flame arc carbons.*

October 31st and November 8th. Deputy P.M.G. Telephone parts; switchboard; instruments, &c. Schedules Nos. 1,363, 1,364, and 1,368.*

December 11th. City Council. Supply and erection of coal transporter plant. See "Official Notices" September 15th.

PERTH.—November 8th. P.M.G. Accumulator parts (Schedule 527 W.A.).*

SOUTH AUSTRALIA.—November 15th. P.M.G.'s Department. Automatic switchboards and all associated apparatus, for telephone exchanges, Brighton and Glenelg.

Johannesburg.—Municipal Council. Twelve gross of carbon brushes for electric motors. (Contract No. 178.)*

New Zealand.—WELLINGTON. October 11th. Public Service Stores Tender Board. 1,000 magneto extension bells, 1,000 ohms.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Aylesbury.—U.D.C. Maintenance of battery, Chloride Co.

Bradford.—B. of G. Messrs. T. Broadbent & Sons, a 48-in. electrically-driven hydro extractor (£197) for the workhouse laundry.

Derby.—T.C. Accepted tenders:—

R. Wade & Sons.—Poles, £134.
B.I. & Helsby Cables, Ltd.—Armoured cable, £2,990; copper cable, £500; sundry materials, £50.
British Thomson-Houston Co., Ltd.—Switchgear, £253; extension of main station switchboard, £262.
British Electric Transformer Co., Ltd.—375-KW. transformer, £286; 150-KW. ditto, £160.

Hebden Bridge.—U.D.C. Messrs. Connolly Bros., Ltd., 400 yards of cable; Mr. O. Watson, for laying the same.

Ilford.—In reference to the current contract with Messrs. A. Foster & Co. for 500 tons of Graigola large Welsh coal, at 28s. 5d. per ton, the Electricity Committee reports having been notified by the contractors that the price is to be increased by 2s. 6d. per ton, under the Price of Coal (Limitation) Act.

Kingston (Surrey).—The following tenders have been accepted for coal to the electricity works:—

Spencer Whatley, Ltd.—12 trucks (approximately 110 tons) South Leicester 1¼-in. main nutty slack, 20s. 7d. per ton; and 12 trucks South Leicester 1¼-in. deep nutty slack, 21s. 7d.
E. Foster & Co.—1,200 tons Snibston 1¼-in. slack, 22s. 1d. per ton (delivered 100 tons per month over 12 months); and 1,200 tons Bolsover nutty slack, 22s. 9d. (ditto).

London.—HAMMERSMITH.—The Electricity Committee recommends the acceptance of the offer of Messrs. W. H. Bowater for 100 tons weekly for 12 months of Holly Bank slack coal, at 21s. 6d. per ton delivered at Shepherd's Bush, or at 23s. per ton at Chancellor's Wharf; and of Messrs. Cory Bros. & Co. for 100 tons per week to end of December, 1916, of Aberclyd small coal, at 27s. per ton alongside wharf.

Maidenhead.—T.C. Crynant Colliery Co., Ltd., 600 tons of large Welsh steam coal. Messrs. George Hinchliffe & Co., 400 tons of large Llydcoad Welsh coal.

Salford.—Tramways Committee. Messrs. Isaac Bentley and Co., Ltd., for a six months' supply of oils and paints, £600.

The Electricity Committee is accepting the tender of the British Westinghouse Co., at £275, for equipping a blank cubicle with H.T. switchgear, together with the necessary control panel, in connection with a 1,000-KW. rotary converter recently supplied by them.

Walthamstow.—Lighting Committee. Accepted offers: Cleeves & Co. and Hinchliffe & Co., for a supply of Griff peas, and has decided to allow Messrs. Cleeves to substitute Griff peas at 24s. per ton in place of D.S. nuts at 26s. per ton under their contract.

Wednesbury.—T.C. British Westinghouse Co., rotary converter, £3,190, for the King's Hill district.

FORTHCOMING EVENTS.

Chief Technical Assistants' Association.—Saturday, October 7th. At the Tavistock Hotel, Covent Garden. Discussion on "Advantages and Disadvantages of Electrical and Steam-driven Auxiliaries," opened by Mr. Thompson.

Association of Mining and Electrical Engineers.—Saturday, October 7th. At the Midland Hotel, Manchester. General Council and annual meeting.

Salford Technical and Engineering Association.—Saturday, October 7th. At 7 p.m. At the Royal Technical Institute. Lecture on "Endurance of Metals under Varying Stresses," by Mr. J. H. Meulen.

Association of Engineers-in-Charge.—Wednesday, October 11th. At 8 p.m. At St. Bride's Institute, Bride Lane, E.C. Presidential address by Mr. F. Bailey.

Electro-Harmonic Society.—Friday, October 13th. At 8 p.m. At Holborn Restaurant (King's Hall). Smoking concert. (See "Notes" to-day.)

NOTES.

Electric Tipping-Wagon Costs.—The last issue of the *Electric Vehicle* contains, amongst other interesting matter, some data regarding the operation of the 3-ton G.V. electric vehicle, fitted with a tipping body and alternative 650-gallon tank for road sprinkling, which has been in use for some time by the Ipswich Corporation. For the year ended March 31st last, the vehicle covered 6,154 miles, and carried an estimated load of over 9,000 tons.

The actual expenses incurred were:—Garage, £18 4s.; repairs, oil, £4 14s.; electricity (7,961 units), £36 9s. 9d.; wages, £75 16s. 8d.; interest (on £958 10s.), £47 18s. 6d.; depreciation (less battery and tires), 10 years' life, £71 19s.; tire depreciation (8,000 miles' life), £38 10s.; battery renewal (two years' guarantee), £94 10s.; insurance and driver's licence, £8 14s. 8d.: making a total of £396 16s. 7d.

It is expected that the battery (Ironclad Exide) will outlast the two years' guarantee, and the tires might have covered over 8,000 miles had they not run over unmade roads, &c. Experience shows that the vehicle is very reliable and economical, and so simple to drive that any intelligent labourer or horseman can be taught all there is to learn in a few hours. Its handiness in negotiating congested streets and in manœuvring to loading and tipping places is a great advantage.

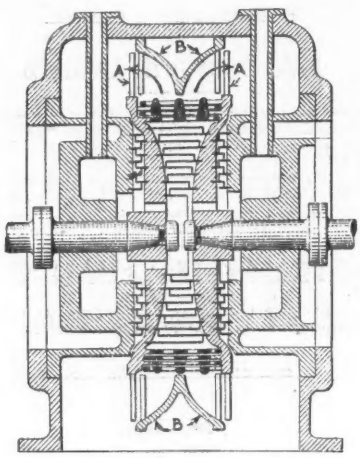
Resuscitation after Electrical Shock.—In the last number of the *N. E. L. A. Bulletin*, Mr. W. P. Strickland, general inspector of the New York and Queen's Electric Light and Power Co., of New York City, says:—

Recently one of our foremen, after climbing a pole, preparatory to stringing primary wires, received a shock that caused him to fall to the ground. It is inferred that in adjusting his belt and shifting his position, his spur cut out, and that, to save himself, he instinctively reached out and touched the wires carring 2,300 volts. When the other linemen and ground hands reached him, to all appearances the man was dead. One of the linemen, following instructions, immediately took hold of the ankles of the limp body, lifting it until the whole weight rested on the neck, and then letting it fall. He then took a pair of connectors, and hammered the soles of the injured man's feet without removing his shoes. Another lineman opened the man's mouth, pulled forward the swallowed tongue (which occurs in electric shock), and was about to begin the Schaefer prone method of resuscitation, when the man returned to life. He was removed to the hospital, and is alive and well to-day, though suffering severely from his burns.

For the past year the writer has been teaching his men to strike the feet without removing the shoes in all cases of electric shock. Some years ago an accident occurred where a man came in contact with 6,600 volts, fell from the pole, and was restored to consciousness by this means, although he was terribly burned, and died three days later. Another accident that came to the writer's attention happened in New Jersey, when a man came in contact with a wire carrying 2,200 volts. This man was struck violently on the feet, his tongue was pulled forward, and he was restored to consciousness before the arrival of the doctor.—*Electrical Review and Western Electrician.*

Ozone in Military Surgery.—A novel method of treatment for wounds, involving the use of ozone, has recently given remarkable results. Wounds which have defied the ordinary methods have quickly yielded to the new treatment, which consists in dispensing with bandages, subjecting the wounds to repeated applications of a stream of ozonised oxygen, and covering them only with a loose layer of lint in the intervals. The painful process of removing and replacing bandages is thus obviated, and healing takes place rapidly without undue inconvenience to the patient. The ozone is generated by electrical means.

Axial Exhaust for Ljungstrom Turbine.—A recent patent describes the addition of radial blades to a Ljungström turbine, as shown at A A in the accompanying sketch. The guide piece B B splits the disk of steam issuing radially from the regular Ljungström blade system and turns it to either side, causing it to pass axially through the blade system A. In the sketch, only one row of stationary guide blades on either side, and one row of



Section Showing Radial Blades.

moving blades attached to either rim of the revolving element, are shown, although more could be used if desirable. A full area is thus obtained for the final exit of the steam, permitting more complete expansion, or, in other words, reducing the "leaving loss." The greater velocity of the blade allows of a greater velocity of steam flow with the same efficiency, which conduces to the same end. The radial disposition of the blades reduces to a minimum the difficulties due to centrifugal force.—*Power.*

Electric Lighting in Motor Garages.—A radical change has recently been made in the rules of the American National Board of Fire Underwriters governing the installation and use of electric light and electrical devices in motor garages. The new rules are not enforced in garages which can only accommodate one or two cars. They provide that in any portion of a building in which self-propelled vehicles carrying volatile inflammable liquid are kept, and any portion of the building that is on or below the floor or floors on which such vehicles are kept, which is not separated therefrom by tight, unpierced fire-walls or fire-resisting walls, all wiring must be done in approved metal conduit or armoured cable, and because of the danger from inflammable vapour, which always seeks a low level, all cut-outs, switches, switchboards, outlet boxes, junction boxes, receptacles, cord connectors, and any contact points at which a spark may be produced by the connection or breaking of the current must be situated at least 4 ft. from the floor. All motors and dynamos (except those actually a part of the vehicle), unless they are of the fully-enclosed type, and all charging panels, unless they have all sparking points surrounded by a vapour-tight enclosure, shall also be at least 4 ft. above the floor.

All cords for portable lamps shall be of an approved type, designed for rough usage, and must carry the male end of a pin-plug connector, the female end being so hung that the connector will break apart readily in any position.

Lignite as Station Fuel.—A considerable share in connection with the maintenance of the economic life of Germany during the war has been taken by the lignite industry in different parts of the country. In Saxony, where the establishment of a Government monopoly of the supply of electricity is under consideration, active discussion has been aroused by the purchase of extensive lignite fields and the proposed acquisition of the Hirschfeld power station of the Electricity Supply Co., which belongs to the A.E.G. group, and which procures fuel from the Herkules Lignite Co. The most important undertaking, however, is in the district of Bitterfeld, where the Electro-Works Co. (late Golpa-Jessnitz Lignite Works) is under an obligation to deliver 500,000,000 KW.-hours per annum to the Imperial Government nitrate works and 250,000,000 KW.-hours to the Electro-Saltpetre Works. The development of the Bitterfeld district during the war is reported to have been so great that many industries have been established there, and the time is foreseen when the rich lignite deposits will no longer be partially converted into briquettes for domestic consumption, but will be used entirely in connection with the production of power for the electrochemical industry and for the recovery of by-products.

Canada Produces Electrolytic Copper.—The U.S. Consul at Fernie, British Columbia, states that the first pure copper known to the trade as electrolytic copper was turned out at the new copper refinery in Trail, British Columbia, on August 20th, 1916:—"The electric current was switched on to some of the tanks containing the copper anodes, and the pure metal, the gold and silver values being left in the slimes, was the result. In the near future a daily production of 10 tons is expected. This is the only place in Canada where pure copper has been made."

New Zinc Industry in Norway.—According to a U.S. Consular report, new works are about to be started at Drammen for the extraction of zinc by an electric wet process, invented by a Belgian engineer. Raw materials for the first year, about 10,000 tons, have been secured, and special attention will be paid to ores containing from 8 to 30 per cent. zinc, which have hitherto been considered worthless.

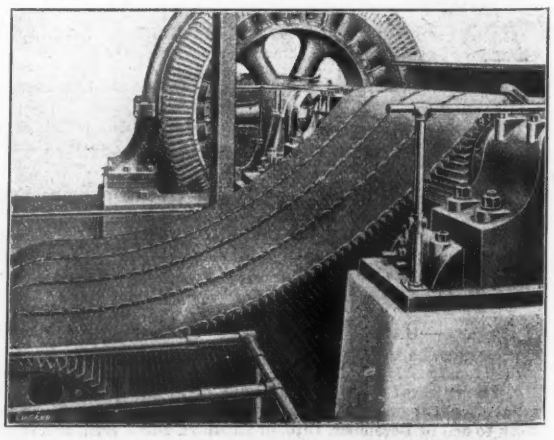
Sulphite Refuse as Fuel.—A factory is to be erected at Greaker, in Sweden, for the utilisation of refuse from sulphite. A Swedish engineer has invented a method for extracting a substance from sulphite lye which, in powdered form, will be made into briquettes and used as fuel. It is claimed that the powder thus formed yields 6,000 calories per kg., while the best English coal gives 7,000.

The Mechanism of Light Production in Animals.—This subject has recently been further investigated by Prof. E. Newton Harvey, at Tokio, who gives a short account of his researches in *Science*. He finds that the dried and powdered luminous organs of the firefly behave like the compound lophin (triphenylglyoxaline) investigated by Radziszewski, which, if hydrolysed in the presence of oxygen by alcoholic potassium hydrate, emits light with the formation of benzoic acid and ammonia; in the absence of oxygen, no light is produced, and benzaldehyde is formed instead of benzoic acid; the alkali acts as a catalyser.

In the firefly it is natural to suppose that an organic catalyser, an enzyme, is concerned in light production, and Prof. Harvey states that the existence of such an enzyme has been definitely proved. He gives the credit of the discovery entirely to Prof. Raphael Dubois, of the University of Lyons, who experimented on the subject in 1884, but whose work has received little attention. He confirms Dubois's discovery that two substances are present in the luminous organs of *Pyrophorus noctilucus*, the West Indian cucullo: a thermostabile substance, luciferin, which oxidises with light production, and a thermolabile enzyme, luciferase. In 1887, Dubois showed that the same was true for the luminous mollusc, *Pholas dactylus*, and Prof. Harvey has isolated these substances derived from various sources. Luciferin of one form will act with luciferase of another, and *vice versa*, in producing luminescence, but whether the luciferin and luciferase of all forms are identical is still an open question. Mr. Harvey has recently discovered that pyrogallol will produce light with vegetable oxidases (potato or turnip juice) on the addition of hydrogen peroxide; as little as one part of pyrogallol in 254,000 parts of water gives perceptible light, and the behaviour of the substances is closely analogous to that of the animal products, the pyrogallol + H_2O_2 corresponding to luciferin and the vegetable oxidase to luciferase. He concludes that the problem of bioluminescence has been solved in its broad aspects, though it will take some time to fill in the details.

The subject has always been of interest to electrical engineers in its bearing upon the future of electric lighting.

A Large Chain Drive.—In the *American Machinist* a description is given of a hydroelectric plant in which a silent-chain drive is employed to transmit no less than 5,000 H.P. The installation is situated on the Snake River, Oregon, where a fall of 21 ft. is available: it was originally intended to increase the head to 42 ft., and the power plant had been purchased for that head, when funds ran short, and the owners were unable to build the necessary dam. On the advice of Prof. J. R. Allen, it was decided to make the best of the circumstances by gearing two turbines, running at the speed corresponding to the reduced head, to one



Chains Transmitting 2,500 H.P.

generator running at its designed speed. Gear wheels could not be used, owing to the space and cost required, and, with some misgivings, the use of chains was decided upon, as involving the least cost and space. A view of the four chains employed to transmit the power of one turbine is given herewith; each chain is 21 in. wide, of 2 in. pitch, and the distance between centres is 129 in. The chains, made by the Morse Chain Co., run at 1,765 ft. per minute, and are almost noiseless. The plant has been running for two years without giving any trouble.

"The Delineation of Internal Organs by an Electrical Method."—An article which appeared in the *British Medical Journal* under this title, on Saturday last, has been much quoted in the lay Press, and, coming from such a source, cannot be lightly regarded. The claims that are made for the method are, however, so extraordinary, and the means by which the results are obtained are so obscure and vaguely described, that we must express the gravest doubts as to the trustworthiness of the account.

A lengthy but unconvincing description of the apparatus employed is given by our contemporary, together with reproductions of diagrams or pictures reported to be obtained by the process, which are equally lacking in verisimilitude. Without following the original account in detail, we may briefly say that two batteries, A and B, are employed, of "equal strength, together with a means by which alternations in their currents can be produced and varied at will." Battery A is connected to a metal screen A, 18 in. by 12 in., which stands vertically on a pedestal near, but *not touching*, the patient's body. Battery B is connected to a screen B, which is supported horizontally 4 or 5 ft. above the centre of screen A. "The primary result of this arrangement is that any electrical field emanating from screen A is always at right-angles to that of screen B. The fields themselves are respectively charged by the currents derived from the batteries A and B with their alternating interrupters. Consequently, it is open to the operator to choose at will the section of the body which shall be brought within the influence of the combined electrical fields, as also the plane of the body which the lines of force in field A shall affect." Another curious statement is that "at given instants of time during the operation of the appliances, the current in electrode B is very unstable, consequently it has placed around it a wire coil, which insulates it from atmospheric electricity." The patient having been placed in the right position, quite close and head on to screen A, and with the affected organ directly under screen B, though at a considerable distance from it, a wax sheet is placed upon a recording cylinder and "the currents from batteries A and B are simultaneously released." The recording cylinder revolves under a stylus called "the hammer needle," which traverses the cylinder *twice* from end to end; the currents are then cut off. "What has happened in the meantime is that the current from battery A has reached electrode A, and has thence been projected horizontally from all parts of screen A as an electric field." The same thing is said of screen B, except that the direction of the field is "vertically downwards." "What has also happened is that the two fields have met at right angles, and as they are of precisely equal strength, and are synchronised in respect of alternations, it might be expected that they would have precisely neutralised one another, and that consequently no exhibition of dynamic force would be obtainable from them. But in practice this is not what occurs." We should think not. It would be interesting to see any kinds of fields at right angles neutralise one another. But these electric fields are new to our experience, and we learn that in practice "an effective current from below always manages to reach electrode B, and thence passes to the detector." The result is a diagram on the revolving wax sheet "which precisely resembles the outline of the living tissues lying vertically below screen B."

The writer remarks that "when the results are compared with the visible means by which they are reached, they seem at first quite incomprehensible, if not incredible." We agree. The inventor, we are informed, "believes that the results are primarily due to the fact that the process interposes between two alternating electric fields of equal strength—*and at the precise point where they meet*—a third electric field, whose facultative potential force is thus released, and can be converted into dynamic power. It is this released circuit which operates the recording needle, and the pattern tapped out on the revolving cylinder varies with the shape of the organ furnishing that circuit." The italics are ours.

The writer remarks that the foregoing is one legitimate way of summarising the inventor's view in simple language. It is, indeed, simple, with the exception of the word "facultative," the bearing of which upon the subject is obscure. But "another would be to say that the force operating the needle is the balance of current which remains after the horizontal current from electrode A, reinforced by the electricity contained in the organ through which it has passed, has met the descending current emanating from electrode B." Without tiring the reader with further quotations, we may point out that the author of these incantations obviously has no conception of the configuration of electric fields or of their properties; he has utterly mistaken and distorted ideas regarding electric circuits and currents, and, if he is not misquoted, confuses these two terms; no intelligible particulars of the recording mechanism are given, and the electrical connections are only vaguely suggested. That such an equipment could by any possibility produce a definite representation of any part of the body or of anything else in the world, is utterly unbelievable; the language is that of quackery from start to finish, and we fear our esteemed contemporary has fallen a victim to a stupid or malicious imposture.

Claim by the Victoria Falls Power Co.—In an action recently begun in the local division of the Supreme Court, the Victoria Falls Power Co. sued the Brakpan Mines, Ltd., and the Consolidated Mines Selection, Ltd., for £692, the balance unpaid of an amount of £2,321 for steam energy supplied by the plaintiffs during August, 1914, in terms of a contract dated March 9th, 1910, entered into between the plaintiffs, the Consolidated Mines Selection Co. and the Brakpan Mines, Ltd.

According to a report in a South African newspaper, plaintiffs further sought to recover £1,753, payments made to the defendants between July, 1913, and February, 1914, under, it is alleged, a mistake of fact in the belief that the contract mentioned contained a clause entitling the defendants to a rebate on the prices for steam energy, whereas the contract contained no such clause.

Defendants in their plea said it had been agreed between the parties to the contract that the terms of the agreement to be drawn up should not be more favourable to the Brakpan Mines than those in the agreement then in existence between the Rand Mines Power Supply Co. and any of the Rand Mines groups, and that the defendants should have exactly the same favourable terms in regard to the air supply as those granted by the Rand Mines Supply Co., Ltd., to any of the companies comprising the Rand Mines groups. When the contract was finally completed and signed, the clause embodying the agreement referred to was omitted owing to a mutual mistake. Defendants pleaded that there was a clause in the Rand Mines contract referred to, to the effect that if there should be any increase or reduction in railway rates, siding charges, &c., on coal consumed by the Power Co. above or below those ruling on January 1st, 1908, the difference in cost of producing power occasioned thereby should be added to or deducted from the prices specified in the contract. The amounts of £692 and £1,753 represented rebates which, it was claimed, the plaintiffs were bound to allow defendants by reason of reductions made in railage charges on coal subsequent to January 1st, 1908, and which defendants were entitled to claim.

Alternatively defendants claimed that the plaintiff company was not entitled under the terms of the licence of the Victoria Falls Co. to charge higher prices than those which defendants would have had to pay after the reductions of the £692 and £1,753. The railway charges on coal consumed by the plaintiff company had so far been reduced below those rates on January 1st, 1908, and the defendants would be entitled to the reductions referred to.

Defendants in reconvention claimed the rectification of the contract.

Plaintiffs in their replication denied the allegation that the contract was not complete, and held that it was binding and final as it stood.

The hearing was adjourned.

A 15,000-H.P. Vertical Turbine.—The electrification plans of the Puget Sound lines of the St. Paul Railway include a great system of power houses to supply the current necessary for the operation of these lines; the transmission lines of the Montana Power Co., which has undertaken to supply the road with power, form a network that covers the greater part of Montana and a portion of Idaho, not only supplying electric power for the 440 miles of railway that are being electrified, a large portion of which is now in operation, but also furnishing power for many mining enterprises. For this work the power company has 12 power stations, either already developed or projected, and by a complete system of interconnections a constant supply of power is insured.

These stations, which will have an ultimate capacity of 243,890 KW., supply alternating current at 100,000 volts, which at the points where it is used is stepped down to the required pressure. In the case of the railway, the current is utilised at 2,300 volts by motor-generators, which furnish direct current at 3,000 volts to the trolley wires.

One of the smaller power stations is operated by steam turbines, but all the rest depend on water power, and to supply this a number of reservoirs have been established in different places. The largest reservoir, at Hebgen, has a storage capacity of 300,000 acre-ft., located at the headwaters of the Madison River, and this can supply in turn the several installations on the Madison and Missouri rivers, so that the same storage water is used a number of times, giving an available storage capacity considerably greater than the above figure would indicate. Besides this great reservoir there are several auxiliary reservoirs at various points that bring up the total available capacity to 418,000 acre-ft.

The largest of this great system of power plants is at Great Falls, Montana; there are six turbines at this station, each rated at 15,000 shaft H.P., that will give a combined output of 90,000 H.P. In addition to the main turbines, there are being installed two similar units of 850 H.P. each for driving the exciters.

The big turbine has a single runner working in a cast-iron scroll case, and operating under a head of 150 ft., and its size may be judged by the fact that the intake is 8 ft. in diameter. The shaft of this turbine is vertical, and the moving parts of both the turbine and the electric generator are suspended from a thrust bearing on the top of the generator.—*Scientific American.*

Fuel Economy in the U.S.A.—The recovery of the valuable by-products from American coke manufacture made big advances in 1915, and has now attained the proportions of an important industry. The value of these by-products last year was nearly $30,000,000, a large increase over the previous high-water mark of $17,500,000 in 1914. Under the spur of almost fabulous prices for benzol products, retort coke-oven plants throughout the country quickly installed elaborate benzol-recovery systems, and now save the valuable oils that not very long ago were being burned or wasted, or, if saved, were begging for a market. The benzol products obtained in 1915 amounted to 16,600,657 gallons. More than 138,000,000 gallons of tar were obtained from coke ovens, and sold for $3,568,384, in 1915. The ammonia brought a total of $9,867,475 to the producers. Surplus gas to the extent of 84,356,000,000 cb. ft., valued at $8,625,000, was sold or used. The by-products, which had a total value of $29,824,579, were obtained by the carbonisation of 19,500,000 tons of coal, from which was also obtained 14,000,000 tons of coke, valued at $48,500,000. The total value of the coke and by-products was more than $78,300,000. —*Science.*

Appointments Vacant.—Works electrician (12s. per day) for the Municipality of Port Elizabeth, South Africa. See our advertisement pages to-day.

Electro-Harmonic Society.—The first smoking concert of the season will be held at the Holborn Restaurant (King's Hall), on Friday evening, October 13th, 1916, commencing at 8 p.m. The programme is as follows:—Tenor, Sapper Frank Webster; bass-baritone, Sapper Joseph Farrington; comedian, Mr. Ben Osborne; humorous entertainer, Mr. Walter Churcher; solo violin, Signor Francesco Vigliani; entertainer at the piano, Mr. Leslie Harris; solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M. Captain H. Riall Sankey, C.B., late R.E., has kindly consented to take the chair.

Electric Steel in France.—A new electric steel furnace has just been brought into operation at a power station of the Tramways Départementaux, where it is being used for the smelting and refining of the steel turnings arising from the shell factories in that region. The furnace, which is said to be of the Keller type, will be able to deal with 30 tons of turnings per day, yielding 25 tons of steel. Power is supplied from the Eymoutiers Works at a pressure of 30,000 volts, reductions to 10,000 volts and then to 100 volts being made at the tramway station.

German Wiring Rules.—Further modifications have been made in the wiring standards and practice laid down by the German Electrotechnical Union (V.D.E.), in order to effect yet further economies in cotton and reclaimed rubber. Cotton may no longer be used as covering material for rubber-insulated zinc and aluminium conductors of 16 sq. mm. (say, 7/16 S.W.G.) and larger cross-section. In rubber-insulated zinc and aluminium wires, and in armoured wires, a paper sheathing is now to be used over the rubber in place of the rubber or impregnated strip, formerly prescribed for the duration of the war. An earlier rule permitted the use of paper in this connection, but did not make it compulsory. Flexible conductors for use with counterweight fittings in low-pressure installations are temporarily removed from the rules, and will not be made until further notice. Probably this deletion is due to difficulty in making satisfactory conductors of this type from "substitutional" materials, though it may, of course, be in the nature of a war economy by suspending manufacture of a class of wire which cannot be said to be indispensable. The Commission recommend especially that, wherever possible, use be made of wiring composed of materials of which there is no shortage, *e.g.*, paper-insulated sheathed wiring. Conduit should only be installed where absolutely essential. For the duration of the war, and for some time thereafter, copper for wiring purposes, may have a resistance of 20 ohms per km. per sq. mm. cross-section at 20° C.; the standard on which the I.E.E. wiring table is based is approximately, 17·5 ohms per km. per sq. mm. at 20° C.

Wages of Electricity Works Employes.—A number of men employed by the Islington Borough Council in their electric light department applied for leaving certificates at the London Munitions Tribunal on Tuesday, on the ground that they were not being paid fair wages. They asked that the 7d. per hour paid to labourers should be increased by 2d., with a proportionate increase to gangers and handymen and Trade Union conditions for other employés except engineers and bricklayers, whose Unions were acting separately. It was stated that some 70 or 80 men were involved. After a long consultation in private, the Chairman said that the Court were of opinion that the Council ought to take into consideration the question of whether the fair wages clause had been observed. They were of opinion that the undertaking was now a certified munitions factory, and that it had been brought under a clause which called upon it to pay a rate of wages no less favourable than those recognised in the district by trade societies. The case would be adjourned, so that the Corporation might consider the matter, and to give them an opportunity of negotiating with the men. If at the end of the negotiations the men felt that they had a grievance, they could come back to that Court.—*Morning Post.*

A Remedy for Slippery Iron Plate Floors.—Writing to the *American Machinist*, Mr. W. A. Lailer says:—

In one part of our shop we have installed a large area of sheet-iron floor-plates that were entirely satisfactory until the corrugations wore off, after which the smooth-worn plates gave considerable trouble owing to several nasty falls of the men that resulted—the trouble being enhanced because of the presence of oil and grease. Roughening the plates by means of chipping was tried, but this could not be done very satisfactorily nor without excessive wear on the plates.

It then occurred to us to try to corrode the plates slightly as often as necessary, to prevent them from becoming too slippery. Since a deep rusting effect was not desired, because of excessive eating-away of the plates, we arranged to take care of it in the following manner: We take a small amount of powdered salammoniac, which is used as a corroding agent in our work, and mix it up thoroughly with a large quantity of fine sand. This mixture is then sprinkled over the floor so that all parts are covered, and then the whole mass is watered, using an ordinary sprinkling can, and left to lie over night. In the morning the sand is swept up, a rust coating being produced by the action of the salammoniac that will last for several weeks, after which the process is repeated.

We found that this method involved less time and cost and was more effective in eliminating danger from slippery iron plate floors than any other of which we have heard

Inquiries.—Makers of the "Volco" battery, marked "S.P.S. & S., Ltd.," and makers of the Flaman (Paris) speed recording instruments, are asked for.

A correspondent is anxious to get into touch with a firm able to supply windmills for driving dynamos.

Volunteer Notes.—First London Engineer Volunteers.—Headquarters, Chester House, Eccleston Place, S.W.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, October 9th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.25—8.

Tuesday, October 10th.—School of Arms, 6—7. Lecture, 7.15, "Organisation and Discipline," Company Commander A. Hynam. Range Practice.

Wednesday, October 11th.—Instruction Class, 5.45. Platoon Drill, Platoon No. 1. Range Practice.

Thursday, October 12th.—Platoon Drill, Platoon No. 7. Range Practice.

Friday, October 13th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, October 14th.—General Parade, 2.45; Uniform, for Drill.

Sunday, October 15th.—Entrenching.—Parade Victoria Station (S.E. & C. Railway). Booking-office, 8.45 a.m.

(By order) Macleod Yearsley, *Adjutant.*

October 4th, 1916.

Electrochemistry in Norway.—The Fredriksstad Elektrokemiske Fabriker A.S. has increased its share capital from 350,000 kroner to 700,000 kroner.

The Bremenger Power Co., whose head office is at Bergen, has decided to raise its share capital from 600,000 kroner to 5,000,000 kroner. The company also intends to utilise the Sælvas stream, in Bremenger, to the extent of 21,000 turbine H.P., and to establish a carbide factory with an estimated annual output of 30,000 tons of carbide; also a cyanamide factory. The aggregate capital of the several concerns is put at 9,000,000 kroner.

Electric Farming in Canada.—According to telegraphic information received at the office of the High Commissioner in London for Canada from the Minister of the Interior at Ottawa, a large number of farmers within a radius of 50 miles of Lethbridge, Alberta, will shortly install electrical plants for various purposes on their farms. These plants are run by small petrol engines, and cost from $300 to $500 (about £62 to £103) each, according to the power generated.—*Board of Trade Journal.*

Fatalities.—On Saturday last an assistant electrician named Gerald J. MacErlean, aged 18, in the employment of Mr. Stanley Johnston, electrical engineer, Belfast, was killed in the Inver Bleaching Works, Larne. He was carrying out some electrical repairs in the bleach house, and while working at some wires near the roof his sleeve was caught in some cogwheels. He was found hanging over the shafting, and was dead. There were lengths of electric wire coiled round the body. His head was almost severed from his body.

At Peak Dale, last week, an inquiry was held into the death of Tom Bennet, aged 35, a wagoner and weighman employed by the Buxton Lime Firms Colliery, who was found dead in a tunnel, lying on a pipe through which an electric wire ran. The inquiry was attended by Mr. G. Scott Ram, Electrical Inspector to the Home Office, Mr. J. D. Mottram, and Mr. W. J. Charlton, Inspectors of Mines, and Mr. A. C. Ainsworth, for the company. Mr. T. C. Griffiths, electrical engineer for the company, said that this particular line of wiring was there before his time. It was to provide light for the tunnel. Verdict: "Killed accidentally by an electrical discharge."

REVIEWS.

A Manual of the High-Speed Steam Engine. By H. Keay Pratt, A.M.I.Mech.E. London: Constable & Co. Price 5s. net.

The high-speed steam engine may be said to be a direct outcome of the activities of the electrical engineer.

When electric lighting first came into vogue the dynamos were driven by ordinary steam engines coupled up by belt. It was soon seen that there were many objections to this arrangement and that much better results, to say nothing of space saving, should be obtained by using a direct-coupled engine, assuming that such an engine could be designed and made to run at dynamo speed. We all know the success that was achieved in the desired direction by Willans, Chandler, Brotherhood, Morcom, and other distinguished engineers.

Yet, in spite of the general adoption of the high-speed steam engine in recent years for electrical work, it is remarkable how little has been published about it in book form and dealing exclusively with the practical design and running of this type of engine. Mr. Pratt remedies the deficiency very effectively in the 270-page illustrated handbook under review.

No designer of these engines, however standardised his engines may have become, can fail to find in it suggestions likely to be helpful, whilst it will be of still more general assistance to the greater number of persons engaged in, or responsible for, the running of these fascinating machines.

Though the volume deals primarily with the design of the double-acting, forced lubrication type of engine, the single-acting type is also considered. The various details each have chapters to themselves, such as steam cylinders and adjuncts; valves; pistons; connecting rods, piston rods, crankshafts; baseplates and flywheels; and governors. Materials of construction, as well as foundations and erection, are well discussed. The chapters on testing and on practical working will be found specially helpful to those responsible for the good performance of these engines.

The concluding portion of the book is devoted to descriptions and illustrations—from photographs and working drawings—of a selection of well-known high-speed engines, including the Allen, Alley & MacLellan, Belliss & Morcom, Brotherhood, Browett & Lindley, Bumsted & Chandler, Chandler, Sisson, and Willans. The distinctive features of the several designs are skilfully touched upon by the author, making this chapter of value also to the potential purchaser of a high-speed engine as well as to the designer and maker.—G. S. S.

Arithmetic for Engineers. By Chas. B. Clapham, B.Sc. London: Chapman & Hall. Price 5s. 6d. net.

The "directly useful" technical series of text-books issued by Messrs. Chapman & Hall already includes a number of valuable manuals for engineers, and this latest addition by Mr. Clapham is in no way inferior to its predecessors. The series is designed to occupy a midway position between the usual types of theoretical and practical text-books, and *Arithmetic for Engineers* deals with the subjects of algebra, mensuration, logarithms, graphs, and the slide rule with a distinct bias towards the practical, but without entirely neglecting the theoretical side of these subjects.

As the author rightly points out in his preface, the title of the book inadequately describes the contents, but the more apt title of "Mathematics for Engineers" had already been chosen by Mr. Rose for a more advanced treatise in the same series—hence this misnomer. The subjects dealt with in the present volume are the simpler portions of practical mathematics—vulgar fractions, decimal fractions, symbols and their uses, simple equations, logarithms, mensuration, graphs, and the slide rule. Every section is treated in a remarkably complete and painstaking manner, indicating that the author has had considerable experience as a teacher of mathematics. Diagrams to illustrate the examples and worked exercises of all kinds abound, and no detail has been thought too small to merit careful attention. In fact, the attention to detail is carried to such lengths as to render some parts of the book verbose, and the necessity for more than the mere passing mention of some of the matters to which whole paragraphs are devoted seems to us quite superfluous. It is just as fatal to labour a subject overmuch as to scamp it unduly, and a book written so laboriously as to ensure the understanding of the veriest duffer is liable to be tedious to the average student. Mr. Clapham certainly seems to be catering for a very block-headed type of student in some of his earlier pages; but it is also true that the majority of text-books on elementary mathematics seriously err in the other direction—by taking far too much for granted.

Chapters I and II deal with vulgar and decimal fractions, and contain a multitude of examples taken from every conceivable branch of engineering science. Important paragraphs in Chapter II deal with degree of accuracy and approximation for result—two points to which it is essential that the attention of all engineering students should be directed in the very early stages of their mathematical training.

The chapter on symbols deals fully with brackets, square roots, powers, and indices. A very useful section is devoted to clearing up the difficulties which the beginner invariably discovers in connection with the addition and subtraction of + and − quantities. The illustration of this by reference to changes of temperature on a thermometer is apt and well written.

At first sight, a chapter of 30 pages on simple equations would appear to be an untimely waste of space in a book which has already dealt in some detail with subjects which are usually taken at a much later stage, *e.g.*, indices and square roots. But Mr. Clapham has found so many things to say about these "short statements that two things are equal" that it would be utterly impossible to spare even half a dozen of these pages without injuring the treatment. Included in this chapter are examples of simple equations involving fractions, brackets, indices, and surds.

Although regretting lack of space for the fuller treatment of the theory of logarithms, the author has not wholly neglected the theory, while he has given a very complete account of the use of logarithms with a large number of practical examples.

Chapter VII. on mensuration, is undoubtedly the most valuable portion of the book. In just over 100 pages the author has covered all the ground usually covered in mensuration books, and not only so, but he has provided a unique collection of illustrated examples which are worthy of unstinted praise. Starting with units and measurement, this chapter deals in succession with perimeters, angles, and areas, and the following chapter completes the treatment by dealing with volumes and surface areas; useful tables of circumferences, areas, and volumes of all the principal figures are given at the ends of these chapters.

The last chapters on graphs and the slide rule are both clearly written accounts, with many examples worked out in full, and others left for practice by the student.

It is extremely difficult to estimate the true worth of this book taken as a whole, or to recommend it to any particular type of student. Some parts of the first three chapters, and the whole of the rest of the book, may be regarded as covering the average first and second-year courses in arithmetic given to engineering apprentices. But the greater portion of Chapter I, and much of Chapters II and III, is certainly work that should be done in the elementary school before a boy can call himself, by any stretch of the imagination, an engineer. In fact the early part of the book is more correctly "Arithmetic for Everybody," for the student who becomes an engineer before he knows the meaning of plus and minus, or can cancel a vulgar fraction down to its simplest form, is surely extinct in these days, and it is not now necessary to explain the multiplication of $\frac{3}{4}$ by 5 in five steps (page 22) to anyone above the age of 12. The latter part of the book can be heartily recommended to young engineering apprentices for its very thorough treatment of logarithms, mensuration, graphs, and the slide rule.

The book is well indexed and serviceably bound, and is fair value for the price asked.—P. H. S. K.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Erith U.D.C. has decided to grant a payment of £50 to the electrical engineer and manager, Mr. J. C. Williams, in respect of services rendered.

Rugby U.D.C. has increased the salary of Mr. Shenton, manager of the electric light works, by £25 a year to £250.

The Walthamstow Lighting Committee has decided to fix the wages of Messrs. G. F. Bridgman and H. J. Halliday, who have been trained by the electrical engineer as switchboard attendants, at 25s. per week each, rising by half-yearly increments of 2s. 6d. per week to 35s. Mr. R. E. Mason, switchboard attendant, is to be promoted to the position of junior charge-engineer, with an increase of 2s. 6d. per week, and his maximum salary is to be increased to 45s. a week.

The Kendal Electricity Committee has decided to increase the salary of its electrical engineer by £25 from October 1st, making £200 per annum.

On 2nd inst., Mr. J. S. D. Moffett, of West Ham, took up his duties as general manager of the Belfast Corporation tramways, in succession to Mr. Andrew Nance.

Mr. J. Buchanan, engineer-in-charge at the Hammersmith B.C. electricity works, has resigned his position.

General.—Mr. Chas. Mayfield, electrical engineer, of London, was married last week, at Clifton, Bristol, to Miss Laura Coates, daughter of Colonel Coates, late Sheriff of Bristol.

Mr. W. E. Waters, secretary and cashier at the Farnworth D.C.'s electricity works, who has accepted an appointment at Messrs. Cammell, Laird & Co.'s works, at Sheffield, has been presented by the members of the Farnworth staff with a smoker's cabinet and set of pipes.

Mr. John Roothaan, manager for Messrs. Ferranti, Ltd., electrical engineers, Hollinwood, Manchester, is now in the hands of the Germans. He was one of the 66 passengers on the Dutch liner *Prins Hendrick*, which, whilst on a voyage to Gravesend, was captured by the Germans and taken to Zeebrugge. Mr. Roothaan was returning from a visit to Amsterdam in connection with the firm's business.

London Gazette Notice.—Territorial Force. Royal Engineers. *Tyne Electrical Engineers.* Second-Lieutenant Lionel Horton (Royal Warwick Regiment) to be Second-Lieutenant.

The Manchester City Council, on Wednesday, approved the action of the Tramways Committee in granting the request of the Board of Trade for permission for Mr. J. M. McElroy, general manager of the Corporation tramways, to act as referee to determine the difference between the Bacup Corporation and the Rawtenstall Corporation *re* stages and fares.

Mr. H. Browne, Messrs. Falk, Stadelmann's representative for the South of England, has been appointed to the London Electrical Engineers' Territorials. Arrangements have been made for his colleague, Mr. C. H. Beazley, to wait upon his clients during the remainder of the war.

Roll of Honour.—Captain R. S. Wadie, King's Own (Royal Lancaster Regiment), reported wounded, is the son of Mr. W. S. Wadie, electrical engineer, of Chiswick, W.

Gunner R. H. Saunderson, of the R.F.A., formerly on the staff of the Carlisle electricity works, has been granted a

gold medal by the King of Serbia in recognition of his gallant services during the campaign of the Mediterranean Expeditionary Force.

Gunner Chas. Hodson and Private R. Ashworth, Loyal North Lancashire Regiment, employés of Messrs. Dick, Kerr and Co., Ltd., of Preston, are reported killed in action. Private E. E. Kayley, Loyal North Lancashire Regiment, also with the same firm, is reported from France to be missing.

Pioneer Bertram Greenwood, of the Royal Engineers, is in hospital suffering from gas enteric. He was employed by a London firm as electrician.

Private Luther McKechnie, R.F.A., has been killed in action. He had been employed at the Keighley and Barrow Corporation electricity works.

Private Alfred Hanson, Somerset Light Infantry, reported killed in action, was an employé of Messrs. T. Smith & Sons, electric crane makers, Rodley, near Leeds.

Company-Sergeant-Major Thomas H. Greenwood, West Riding Regiment, has been killed in action. He was an employé of the Halifax Corporation electricity works.

Lieutenant Edwin Schonfield, London Regiment, aged 26, has been killed. He was, according to the *Times*, engaged in the office of his father's firm, Messrs. A. Schonfield & Co., electrical engineers, Hope Street, Glasgow, before the war. He had been recommended for a captaincy.

We regret to note from the *Times* "Deaths Column" that Second-Lieutenant P. H. Byng, R.F.A., only son of Mr. and Mrs. Max Byng, 4, Kensington Court, W., has died on his 24th birthday in a hospital abroad.

Second-Lieutenant J. R. Moore, Connaught Rangers, killed in action in his 21st year was, according to the *Times*, with the British Westinghouse Co., at Trafford Park.

Second-Lieutenant H. Kingsbury, Royal Garrison Artillery, son of Mr. J. E. Kingsbury, has been wounded in action. He is now in hospital in London, and is doing well.

Rifleman Gilbert Hacking (24), King's Royal Rifles, employed by Mr. Thompson, electrician, Blackburn, has been killed in action.

Private Fred Smith, of the King's Liverpool Regiment, has been wounded in action. Prior to the war he was engaged on electrical work in Paris; he served his apprenticeship at the Winter Gardens electricity station, Blackpool.

Captain Desmond Clere Parsons, Irish Guards, killed in action on September 15th, aged 26 years, was the youngest son of the Hon. R. Clere Parsons, M.I.C.E., A.I.E.E.

Sergeant A. E. Johnson, Lancashire Fusiliers, who was in civil life electrician to the Tenterhouse Bleaching Co., Norden, Rochdale, is reported killed in action after being missing since August 7th, 1915.

Private Vernon West, who has fallen in action in France at the age of 21 years, was before the war on the staff at the Horsham U.D.C. electricity works.

Lieutenant Cyril A. C. Aitkens, R.E., reported as missing in July, and as having died in August, aged 23, according to the *Times*, obtained his first appointment in the Tyne Electrical Engineers Corps. He was articled for five years to the North-Eastern Marine Engineering Works. He rendered excellent signalling service in addition to his other duties, and also saved a number of lives through his skilful dressing in the field.

Obituary.—Mr. John Henry Lee.—Mr. John Henry Lee, who died at Derby on September 24th, at the age of 64 years, was associated with the old Electric Telegraph Co., and entered the Government service at the time of taking over the system in 1870. He was, until his retirement in 1908, telegraph superintendent at Derby.

NEW COMPANIES REGISTERED.

Magnetic Waves, Ltd. (1,525F).—Particulars filed September 28th, 1916. Capital, £25,000 in £1 shares. Registered in Jersey, Channel Islands, in August, 1916, to carry on the business of electro-magnetic wave treatment, &c. British address: 133 and 135, Oxford Street, W. Sir Ernest W. Robinson, Bart., Craigmore, Queen's Road, Jersey; H. G. Barrett, Mill Land, Clayton, Sussex; R. A. Pitcairn, 10, Hanover Square, W.; and T. W. Norman, Spring Hill, Wellingborough, are authorised to accept service. Directors: Sir Ernest W. Robinson, Bart., H. G. Barrett, T. W. Norman, and R. A. Pitcairn.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Ignition Co. (1913), Ltd.—A memorandum of satisfaction in full on September 1st, 1916, of debentures dated May 24th, 1913, securing £2,500, has been filed.

Lancashire Electrical Engineering Co., Ltd. (56,992).—Capital, £5,000 in £1 shares. Return dated July 26th, 1916. 1,878 shares taken up; £50 paid; £1,828 considered as paid. Mortgages and charges: Nil.

Birmingham District Power & Traction Co., Ltd. (19,077).—Capital, £1,050,000 in £10 shares (35,000 cum. pref., 35,000 pref. ord., and 25,000 def. ord.). Return dated June 1st, 1916. 20,978 cum. pref., 35,000 pref. ord., and 35,000 def. ord. shares taken up; £10 per share called up on 20,978 cum. pref., 27,000 pref. ord., and 35,000 def. ord. shares; £829,780 paid; £80,000 considered as paid on 8,000 pref. ord. shares. Mortgages and charges: £403,182.

Edmundson's Electricity Corporation, Ltd. (52,013).—Capital, £640,000 in 80,000 ord. shares of £3 each, and 40,000 cum. pref. and 40,000 non-cum. pref. shares of £5 each. Return dated August 3rd, 1916. All shares taken up; £3 per share called up on 66,800 ord. and £5 per share on the non-cum. pref. and cum. pref. shares; £600,400 paid; £39,600 considered as paid on 13,200 ord. shares. Mortgages and charges: £447,350.

John Davis & Son (Derby), Ltd. (66,606).—Capital, £35,000 in £1 shares (15,000 pref.). Return dated July 6th, 1916. 15,000 ord. and 11,000 pref. shares taken up; £26,000 paid. Mortgages and charges: Nil.

Evershed & Vignoles, Ltd. (43,206c).—Capital, £30,000 in £1) shares. Return dated July 13th, 1916. All shares taken up; £30,000 paid. Mortgages and charges: £15,000.

Chloride Electrical Storage Co., Ltd. (35,389c).—Capital, £135,250 in £1 shares (62,000 pref.). Return dated August 30th, 1916. All shares taken up; £1 per share called up on 48,750 pref. and 26,988 ord.; £75,738 paid; £59,512 considered as paid on 13,250 pref. and 46,262 ord. shares. Mortgages and charges: Nil.

Electric & General Investment Co., Ltd. (31,506).—Capital, £201,500 in 19,900 pref. and 20,000 ord. shares of £5 each, and 40,000 def. shares of 1s. each. Return dated August 8th, 1916. All shares taken up; £5 per share called up on the pref., £1 per share on the ord., and 1s. per share on the def. £121,500 paid. Mortgages and charges: £114,560.

William Denton, Ltd.—Debenture dated September 18th, 1916, to secure £1,200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. D. Parsons, 30, Coleman Street, E.C.

Marconi International Marine Communication Co., Ltd. (65,759).—Capital, £350,000 in £1 shares. Return dated June 28th, 1916. 306,084 shares taken up; £201,084 paid; £1055,000 considered as paid. Mortgages and charges: £114,560.

CITY NOTES.

Metropolitan Electric Supply Co., Ltd.

An extraordinary general meeting was held on September 28th, at Salisbury House, E.C., to consider the report of the shareholders' committee which was appointed at the general meeting in March. [The report was printed in the Electrical Review for September 15th.] Mr. W. Harrison Cripps presided over a comparatively small attendance. In opening the proceedings, after a feeling reference to the loss the company had sustained since the last meeting in the death of Lord John Hay, one of the original directors, he said that the object of the meeting was to confirm a compromise. Compromises proverbially satisfied nobody, and it was useless to pretend that he was entirely satisfied with the arrangement come to between the committee and the board. He would have liked all the questions at issue between the board and those responsible for the appointment of the committee to have been thoroughly thrashed out, and in particular that every shareholder should have been placed in a position to form a judgment on their merits. The publicity necessarily incident to such a process was, however, considered to be adverse to the true interests of the company, and having satisfied himself that an arrangement was possible on the basis of his own resignation of the chairmanship of the board, he could not allow his own wishes or his own interests to stand in the way of what otherwise seemed to be to the advantage of the company as a whole. In resigning an office which he had now held for 17 years, and to the duties of which he had devoted the best years of his life, he would have liked to review the work which had been done and to give his reasons for believing in the existing and future prosperity of their undertaking. Under existing circumstances he could not do this. Were he to attempt it he would be reviving controversies which it was the chief object of the compromise to set at rest. To every word of what he said at the last meeting he still adhered. Much of it had since been confirmed by reports made by Sir John Snell, late President of the Institution of Electrical Engineers, and Mr. Pixley, the well-known city accountant, reports which had been submitted to the committee and would be invaluable to the directors for future reference and guidance. He regretted that the committee in their report did not further explain the statement as to the fall in dividend since 1905, implying that it was the result of bad management on the part of the board, and suggesting that it was the cause of the retirement of certain directors. It was that statement that so thoroughly alarmed the shareholders when asked for their proxies. The earnings of the company had not fallen; they had increased. The actual gross receipts in 1906, the year after the sale of nearly half of the property to Marylebone, were £175,000. Last July they had risen to £253,000, a rise of over 44 per cent.; and they had already received the report of the progress during the past half-year. They would remember that 1906 was the first year after the loss of Marylebone, and was therefore the

first year for ascertaining either increase or decrease of receipts. He explained in March that the initial fall in dividend in 1906 was fully and amply compensated for out of the excellent award of £1,212,000. Included in this sum was compensation for lost future dividends assessed by the arbitrator at no less than £660,000. At a special meeting it was unanimously decided to return that sum, representing the lost future dividends, to the shareholders, who received approximately a bonus of £6 10s. for each £10 share held. He was sorry the shareholders could not have seen Mr. Pixley's report on this vital matter, which entirely supported the explanation given by him (the chairman) at the last meeting. He also saw that the committee suggested that Mr. Highfield's services as engineer should be retained. He feared they could not have followed the facts. The board, fully confident of the value of Mr. Highfield as an engineer, had already retained his services for a period of five years from the commencement of this year. The arrangement come to by the board had been the subject of diverse criticisms. With criticisms made by those who did not share his own views he was in no way concerned. But there were two criticisms put forward by his own supporters on which he desired to say a few words. How, he had been asked, had he brought himself to abandon this or that particular line of policy, or this or that commercial principle on which he had till now insisted as essential to the well-being of the company? His answer was that neither he nor they would have abandoned any line of policy or any commercial principle to which they had heretofore attached importance. The compromise which had been come to decided nothing as to policy or principle. It affected merely a change of personnel in the directorate. The reconstituted board would consider all those questions and determine them to the best of their ability, and in accordance with the best advice that could be obtained. He had no doubt that every member would act *bona-fide* in the interest of the company. As on all boards, there might be differences of opinion, a certain amount of give and take. But obviously questions of that sort were better decided by an authorised board of directors than by an *ad hoc* committee. He had also been asked why, with so many able business men already shareholders in the company, they had thought it necessary to find a new chairman and new directors from outside. In his opinion that criticism was well founded, and he was afraid that he was not altogether free from responsibility. The new chairman and new directors were selected by the committee, but he (the speaker) made it a condition of his resignation that they should be gentlemen not hitherto connected with the company. That might have been taken to exclude existing shareholders, though it was meant only to exclude those who had already taken part in the management of the company. The matter was not, however, now of any great importance. The new chairman and directors, whether taken from inside or outside, might be assured of the cordial co-operation of their colleagues. Mr. George Verity was known to them all as having always taken an interest in the company, and his brother, the late Mr. John Verity, was long a valued member of the board. He had not the advantage of knowing the other two gentlemen nominated, who, however, seemed to have a wide experience of company matters. With close attention to detail, and goodwill on the part of all concerned, he saw no reason why the prospects of the company should not be assured, and for his own part he would in the future, as in the past, do everything in his power to advance the interests of the company, in whose future he had the utmost confidence.

Mr. Roger Gregory, chairman of the shareholders' committee, then moved the adoption of the report of that body. He said that, speaking for the committee, he wished to say how greatly they appreciated the generous terms in which Mr. Cripps had expressed himself in his speech, and for the way in which he had carried out a task which must have been a painful one to him personally. With regard to the report, as the chairman had said, it was entirely a compromise. The task of the committee had been an arduous and a difficult one. They had interviewed numerous witnesses, and had had before them a great mass of reports, some of them of a highly technical and difficult nature, and they had formed their conclusions to the best of their ability. As they proceeded with their work it seemed to himself and his colleagues on the committee that a change in the board was desirable, and he believed they had succeeded in selecting three names which would commend themselves to the shareholders as desirable additions to the board. It might be asked why they had not suggested the three directors whose resignations had resulted in the appointment of the committee, but, as he had said, the report was the result of a compromise. He fully agreed that great credit was due to those who first realised the necessity for an inquiry. With regard to the future, he did not think there was any cause for anxiety about the company's prospects. The shareholders had a very valuable property indeed, and he believed that if it was carefully and properly managed they could look forward to considerable prosperity. The committee had amassed a large amount of very useful information in the course of their inquiries, which would be at the disposal of the new board. Regarding Mr. Highfield's services, he would like to say that he thought all the committee were agreed that they had been of the greatest possible value to the company.

Mr. J. Carr Saunders seconded the motion.

Mr. Toy proposed an amendment to refer the report back to the committee with instructions that they should amplify it and report to an adjourned meeting on November 9th. In the course of a long speech Mr. Toy said he must confess to a feeling of disappointment at the result of the labours of the committee. The report did not give them a vestige of information, and the shareholders were asked to take its conclusions upon trust. They were not given access to any of the reports which had been brought before the committee, and they had not been taken into their confidence in any way. The suggested compromise was inconclusive and unsatisfactory, and if they were not very careful it would land the company in further difficulties.

Mr. Piersall formally seconded the amendment.

Mr. Gregory said he admitted that the report might seem a bald and colourless document, but if it had gone into detail it would have had to deal with the intimate relations that existed between the company and its customers, and such publicity would not have been to the advantage of the company. All the information which the committee had would be placed before the new board, and it would be for that body to deal with it as they thought best in the interests of the shareholders.

Sir R. Melvill Beachcroft, a member of the committee, said they had employed four technical experts occupying probably the highest positions in London in their several professions. Those gentlemen had made their reports, and, as was usually the case, none of them agreed with the others. Under the circumstances he thought the compromise suggested was the best course to take, and he thought the shareholders were indebted to the chairman for having been willing to sacrifice himself in order to bring about an arrangement of the kind proposed. The future of the electrical industry in London was uncertain. Just before the war the London County Council proposed a Bill for amalgamating the companies and buying them out by agreement, which Bill, he was confident, would be reintroduced the moment the war was over. When that time came they would need not a divided board, but one that was united, and they would want the help of the most experienced men who were now dealing with this question.

Mr. Paxton expressed disappointment that the committee had not made any reference in their report to the part taken by Mr. Tuckett in bringing about the inquiry. It was, he said, that gentleman's technical knowledge that showed him that something was wrong as soon as he was elected a director, and the shareholders had to thank him for the part he had taken in the matter.

Mr. Frank Bailey, as an original shareholder, and as one whose official connection with the company ceased five years ago, said he was disappointed with the compromise put forward by the committee, which did not seem to be accompanied by sufficient evidence as to its utility. If the committee thought that Mr. Tuckett, Lord Avebury, and Sir James Pender did right in resigning their seats on the board, they had a right to expect something more conclusive than the report which had been issued. The least the committee could have done was to have made some public recognition of the services of those gentlemen.

On a show of hands the amendment was negatived by a large majority, only nine voting for it, and the report of the committee was adopted.

Mr. A. W. Tait, Mr. George Balfour, and Mr. George Verity were then elected as directors of the company in accordance with the recommendation of the committee, and a further resolution was agreed to directing the committee to place at the disposal of the board the reports of the experts employed by them.

On the motion of Mr. A. Samuel, a cordial vote of thanks was accorded to the chairman for the services he had rendered to the company in that position during the past 17 years, and a similar vote was accorded to the shareholders' committee.

Escher, Wyss & Co., Ltd.

The report for the year ended March 31st, 1916, of the A.G. der Maschinenfabriken Escher, Wyss & Co., of Zurich and Ravensburg, the majority of whose shares passed again into Swiss ownership some time ago, states that the effects of the war were felt considerably less than in the preceding financial year, as a more active demand set in gradually for the company's specialities. It was, however, only possible to take advantage to a moderate extent of this favourable state of affairs owing to the increasing difficulties which arose from the enormous rise in the prices of almost all raw materials and intermediate products, and in obtaining delivery of them. A further hindrance to business lay in the low level of the rate of exchange with individual countries, which in many cases caused contracts to be no longer remunerative. It had therefore been necessary to work other markets to a greater extent, and the hope was expressed that the new business connections thereby obtained would also be maintained after the conclusion of peace. The frequent changes in the workmen and staff in consequence of military requirements and the migration of skilled workmen had an unfavourable effect on the production. Notwithstanding these difficulties, it was possible to raise the degree of activity in most departments almost to the normal level of the last year of peace. During the year the hydraulic turbine

plant for the Barcelona Light & Power Co. was set in operation with very favourable results, and the financial settlement of this great transaction was now proceeding satisfactorily in every respect. The delivery of machinery to different countries, particularly Russia, suffered from great difficulties, especially in the steam turbine department, which consequently did not develop quite as had been expected. In the meantime the demand for steam turbines had increased, and was very active at the present time. After placing £32,000 to the depreciation fund, as compared with £21,000 in 1915-16, the accounts show net profits amounting to £17,000, as against £13,000 in the previous year. It is proposed to pay a dividend at the rate of 4 per cent. on the ordinary share capital of £260,000, being the same as in 1915-16.

Calcutta Electric Supply Corporation, Ltd.—Interim dividend on the ordinary shares at the rate of 7 per cent. per annum for the half-year ended June 30th.

Cuba Submarine Telegraph Co., Ltd.—Interim dividend on the ordinary shares for the half-year ended June, 1916, at the rate of 5 per cent. per annum.

Montreal Light, Heat & Power Co.—Interim dividend at the rate of 8 per cent. per annum for the quarter ending October 31st.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have had an abrupt check to their previous vitality and strength. It was not supposed that the Government would issue any new form of borrowing to come into direct competition with existing securities, so that the offer of three-year 6 per cent. Exchequer Bonds has come as a surprise and a disappointment. Critics blame the Government for this new departure, and complain that holders of the existing 4½ per cent. War Stock have been badly treated, in that their option to exchange into a new loan is once more rendered nugatory by the fact that the latter is in the shape of Exchequer Bonds, into which the proprietors of the War Loan cannot make a direct exchange.

The defenders of the short-term policy point out that the 6 per cent. Exchequer Bonds are likely to prove very tempting to foreign investors, whose money will be useful at the present time in keeping steady the rates of exchange. But for this advantage, it may be wondered whether the Treasury is not paying an extravagant price, and whether a straight-out 5 per cent. longer-term loan would not have achieved an enormous popular success.

The immediate consequence is that all fixed-interest securities have become unstable, and their prices have dwindled. Indeed, for the moment it is difficult to say upon what basis stocks and shares can be valued. Obviously, the 6 per cent. Exchequer Bonds set up a new standard—at all events, for the time being. Severe falls in Consols, the War Loans, Colonials, and similar stocks have been the natural corollary to the Treasury's offer, and no doubt, in course of time, markets will settle down again, just as they did after the advent of the 4½ per cent. War Loan some 15 months ago. But until the investor becomes familiar with the new bonds, and with the standard of comparison which they set up, we are not likely to see any noticeable improvements in the purely investment descriptions.

Home Railway stocks have suffered acutely in that the depression caused by the 6 per cent. issue comes at a time when further Labour trouble among coal miners begins to manifest itself. It was only a fortnight ago that the railwaymen were given a substantial increase of wages, and everybody hoped that the Labour world would be content to carry on under present conditions, at all events through the winter. The coal miners, however, think otherwise, and, in the circumstances, it is not surprising that proprietors of railway stocks should feel somewhat despairing of their investments. The flatness has extended to electric railway varieties, and Districts, Metropolitans, and Underground Electric are all lower on the week. London & North-Western Consolidated dropped below par, in spite of the start which has been made with its electrified suburban system. Underground Electric Income Bonds gave way to 88.

The meeting of the Metropolitan Electric Supply Co. passed off with no more ruffling of the waters than might have been anticipated, having regard to all the circumstances of the case. The resolutions were duly carried; and, as we have said before, the thanks of the shareholders are due to the committee which spent so much time and energy upon the affairs of the company since spring. No change has occurred in the price of the shares, and the Electric Lighting list is steady throughout. The reversion to winter-time had no effect upon prices. It may be recalled that the dulness which occurred in this market upon the introduction of summer-time was recovered in less than a month, so that the success of the scheme was not tinged by so much as a shrinkage in the prices of the shares of the illumination companies.

Anglo-Argentine Tramways begin to show a better tendency. The first preference are up 1/16, this being the first advance which has occurred for many weeks. Brazil Tractions, however, are a weak market; there appear to be several lines of shares about, which have a difficulty in finding permanent homes. British Columbia stocks continue to advance, the preferred and the deferred both showing gains of a point on the week. Mexicans are weaker, though the Tramway Co.'s 5 per cent. first mortgage bonds have recovered their recent small loss. The bonds of the Electric Light and Power Co. fell 2 points, this notwithstanding distinctly more encouraging reports from Mexico than we have been accustomed to of late. Bombay Electric preference are in demand.

The New York financial papers dwell upon the remarkable way in which some of the Mexican railroads are recovering from their misfortunes under the recent chaotic *regime*. Stocks and shares in the Canadian-American power companies are mostly firm, though the spirit of speculation, which has reached boiling point in New York during the past fortnight, has been concentrated upon railway and munition issues, to the exclusion of the more humdrum Utilities. Canadian General Electrics have risen four points to 124.

Marconis reacted to 3, but recovered most of their loss. Americans are quiet at 18s. 3d., and Canadians at 10s. 6d.

Amongst the Industrials, something of a reaction has occurred in armament shares, as well as in the iron and steel department. British Westinghouse preference eased off to 2½; on the other hand, Telegraph Constructions are good at 39½, and Electric Constructions at 18s. 9d. are 1s. 3d. up. Activity in the rubber share market has been checked to no small extent, although prices on the whole keep firm, there having been little selling. The various impositions of excess profits tax in Colonial and Allied countries are exercising their natural effect upon prices of shares in companies connected therewith, and a slight dulness in some of the copper companies' issues is due to this cause.

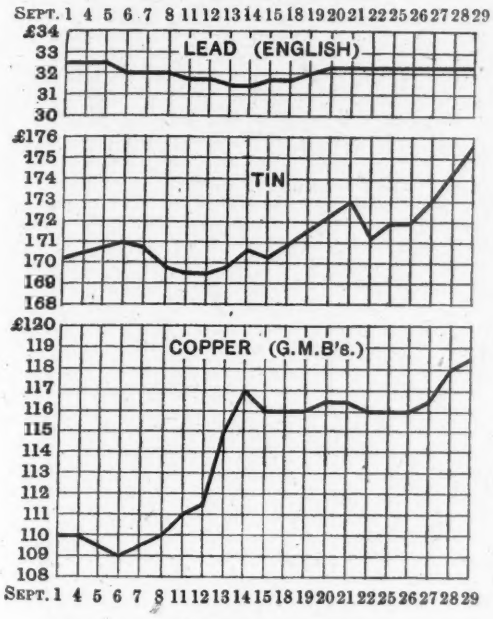
SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Oct. 3, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6⅝	—	£7 11 0
Charing Cross Ordinary	5	5	3 9/16	—	7 1 4
do. do. do. 4½ Pref.	4½	4½	3 15/16	—	6 6 4
Chelsea	5	4	3	—	6 18 4
City of London	9	8	12½	—	6 10 8
do. do. 6 per cent. Pref.	6	6	10⅜	—	5 15 8
County of London	7	7	10 3/16	—	6 9 8
do. 6 per cent. Pref.	6	6	10⅜	—	5 15 8
Kensington Ordinary	9	7	5⅝	—	6 4 5
London Electric	4	3	1½	—	6 10 5
do. do. 6 per cent. Pref.	6	6	4 5/16	—	6 11 4
Metropolitan	3½	3	2⅛	—	5 9 1
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0
St. James' and Pall Mall	10	8	6⅜	—	6 5 6
South London	5	5	2 13/16	—	6 16 1
South Metropolitan Pref.	7	7	1 3/16	—	6 7 3
Westminster Ordinary	9	7	6½	—	5 12 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102	—	5 17 6
do. Def.	80/-	33/6	23½	+ ½	7 8 3
Chile Telephone	8	8	7	—	5 14 5
Cuba Sub. Ord.	5	5	8½	—	6 9 6
Eastern Extension	7	8	14⅜	—	*5 9 6
Eastern Tel. Ord.	7	8	145½	—	*5 10 0
Globe Tel. and T. Ord.	6	7	12½xd	—	*5 11 0
do. Pref.	6	6	10½xd	—	5 11 7
Great Northern Tel.	22	22	42	—	5 4 9
Indo-European	13	13	49	—	6 12 8
Marconi	10	10	3 1/16	—	3 5 3
New York Tel. 4½	4½	4½	100	—	4 10 0
Oriental Telephone Ord.	10	10	2⅝	—	4 6 6
United R. Plate Tel.	8	8	6⅜	—	*5 18 5
West India and Pan.	1	—	1 1/16	—	—
Western Telegraph	7	8	14½	—	*5 8 6
Home Rails.					
Central London, Ord. Assented	4	4	78	—	5 9 7
Metropolitan	1½	1	28½	—1½	4 5 1
do. District	Nil	Nil	17	—1	Nil
Underground Electric Ordinary	Nil	Nil	1 1/16	—	Nil
do. do. "A"	Nil	Nil	5 6	—6d.	Nil
do. do. Income	6	6	88	—	*6 16 4
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4 13/16	—	6 1 6
Anglo-Arg. Trams, First Pref.	5½	5½	3 7/16	—	7 14 5
do. 2nd Pref.	5½	5½	3	—	—
do. 5 Deb.	5	5	75	—	6 13 4
Brazil Tractions	4	4	59½	—1½	6 14 6
Bombay Electric Pref.	6	6	10½	—	5 14 3
British Columbia Elec. Rly. Ptce.	5	5	75	—	6 13 4
do. do. Preferred	—	Nil	61	+1	Nil
do. do. Deferred	—	Nil	60	+1	Nil
do. do. Deb.	4½	4½	67	—	6 10 9
Mexico Trams 5 per cent. Bonds	—	Nil	44	+1	Nil
do. 6 per cent. Bonds	—	Nil	86	—	Nil
Mexican Light Common	Nil	Nil	18	—1	Nil
do. Pref.	Nil	Nil	83	—2	Nil
do. 1st Bonds	Nil	Nil	42	—3	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	3 5/16	—	4 18 0
British Aluminium Ord.	5	7	29/-	+1/-	5 10 4
British Insulated Ord.	15	17½	12½xd	—	7 0 0
British Westinghouse Pref.	7½	7½	2½	— 1/16	6 0 0
Callenders	15	20	12½	—	8 0 0
do. 5 Pref.	5	5	4½	—	5 17 8
Castner-Kellner	20	—	8½	—	5 6 8
Edison & Swan, £3 paid	Nil	—	10/-	—	Nil
do. do. fully paid	Nil	—	1½	—	Nil
do. do. 5 per cent. Deb.	5	5	62½	—	8 0 0
Electric Construction	6	7½	1 5/16	+ 1/16	8 0 0
Gen. Elec. Pref.	6	6	10	—	6 0 0
do. Ord.	10	10	14½	—	6 15 7
Henley	20	25	16½	—	7 9 2
do. 4½ Pref.	4½	4½	4½	—	5 6 0
India-Rubber	10	10	12	—	*8 3 4
Telegraph Con.	20	20	89½	— ½	*6 3 0

* Dividends paid free of income-tax.

METAL MARKET.

Fluctuations in September.



Refining Zinc by Electrolysis.—A good deal of experimental work has been carried out during the past few years at the works of the Consolidated Mining and Smelting Co. at Trail, in the Rossland Division of British Columbia, in connection with the refining of zinc by electrolytic means. Spelter of good quality having in this way been produced to the extent of about half a ton per day, it was, some time ago, decided to establish a special plant capable of turning out up to 35 tons per day. The installation, which includes departments for grinding, roasting, leaching, electrolysing, and melting, an electric power station, and a special dust-collecting plant, is now rapidly approaching completion. The experiments have, so far, been practically confined to the ore obtained from the company's own mines, and thus it is not possible to say whether the same process is capable of dealing with the prevailing zinc-lead ores of the district.

The Electrolytic Coating of Silvered Mirrors.—The old method of coating mirrors by the mercury process is a long, tedious, and unwholesome operation, which has been nearly universally replaced by silvering. The latter method is, however, by no means perfect; the very thin film deposited by reduction of a solution of nitrate of silver is neither as white nor as brilliant as that of tin amalgam; it is deficient in strength, being detached by the slightest friction, and tarnished on exposure to sulphurous fumes. These faults are only very imperfectly overcome by a backing of varnish, of itself often a source of deterioration. Long ago an electrolytic deposit had been considered as a substitute, but experiments in this field yielded only mediocre results, whose irregularity was mainly due to the extreme thinness of the silver coating. Indeed, in the electrolytic method, it is this metallic film which constitutes the kathode, whose very minute cross-section is a poor conductor. When the contact is made around the periphery of the silvered glass, the electrolytic deposit takes place almost entirely in its immediate vicinity, and at points remote from the edges the thickness of the deposit diminishes rapidly, so that at the centre there is scarcely any deposit.

This drawback has been cleverly overcome by Delere, Gresy and Pascalis, whose method is in actual use in Paris by the Compagnie des Glaces de Saint-Gobain. The process consists in multiplying the number of current-carrying points of contact on the silver kathode by means of flexibly supported metallic combs. These combs have brass teeth, to each of which is attached a globule of tin, a soft metal which avoids scratching the silvering. All parts of the electrode immersed in the electrolyte are covered with an insulating layer of paraffin, with the exception of the points in contact with the silvering. The anodes consist of bands of pure copper supported between the contact points. The mirror to be coated is laid, silvered side up, in a shallow tray containing the electrolyte, the latter being kept of uniform strength by forced circulation. During the plating the current is interrupted every few minutes, and the contact points are shifted a short distance. The electrolytic action is thus uniformly distributed over the entire surface, resulting in a very homogeneous deposit of copper. Mirrors so protected resist the action of sulphurous fumes under the most unfavourable conditions, and possess the unexpected advantage of increased reflecting power.—*Journal* of the Franklin Institute.

AMERICAN VIEWS ON THE DESIGN AND MANUFACTURE OF ELECTRIC COOKING STOVES.

The report of the Electric Range Committee at the recent Chicago Convention of the National Electric Light Association contained, amongst other things, an instructive summary of American central station opinion as to design, manufacture, &c., of electric cooking stoves.

Although great progress is being made in electric cooking in the States, it will be noted that the conditions affecting design and production are not unlike those which prevail here.

As regards design, a summary of answers to questions addressed to 46 operating companies shows that types of ranges sold up to the present time have been the products of five manufacturers, all but one of whom have been making various electric appliances for some years past. There were 4,659 ranges reported sold, the majority of those apparently giving good satisfaction both as to operation and number of burners and sizes of ovens. The principal mechanical complaints were burning out of elements, slowness of operation, and fragile construction. There seems to be a variance of opinion regarding the relative merits of the open coil and enclosed burners, the former apparently being the more popular. The type of electric range most desired seems to follow the lines of the popular gas ranges. There should be four three-heat burners on the top (one 1,500-watt, two 1,000-watt, and one 750-watt). The side and upper ovens are by far the most popular. Ovens should be at least 12 by 15 by 18 in., and should contain a broiling element and a baking element. A warming oven above or below the baking and broiling oven is a desirable adjunct. The doors on side ovens should open down.

It will be noted that the gas stove has set the fashion in America as here, although the arrangement of the stove is quite different from that favoured on this side, being much less compact.

Apparently those undertakings which have connected the greatest number of ranges are doing all the wiring in connection with the installations. The costs for installing vary from \$4 to \$30, and average \$12½, and cost price is usually charged.

The demand of the American consumer is for a cooker costing from \$30 to \$40, but apparently many of them pay another \$10 to get "just what they want."

These prices presumably include control switches, which are, we believe, usually attached to American stoves, although frequently forming an item of additional cost in this country.

The majority of the supply undertakings hold the view that a durable and efficient stove, with at least three hotplates and a side or upper oven, should, under present conditions, be obtainable at as low a price as \$30 to \$35, but some concerns fear that low price may mean a sacrifice in quality, which will do harm in the future to electric cooking.

Such a price for an efficient and durable stove of the kind indicated is low, judging by English prices even before the war, but presumably there are reasonable grounds for believing that a stove which will satisfy the consumer can be made at the price in America, whatever may be the case here.

We note that it is recommended that rotary snap switches controlling the service to various heaters should have a distinctive feature, either in colour or position of indicator, or both, when current is off. The distinctive feature at the present time on most of these switches is the reading of the word "off," but in a dim light, or when the eyesight is not of the best, reading is not always easy. A distinctive colour for the lettering of the word "off," or the uniform or distinctive position for the indicator, will quickly convey the idea to the operator whether or not the circuit is disconnected, even if only a hasty glance is given.

British practice for large installations appears to favour the use of pilot lamps as indicators, but very small pilot lamps are open to objection, and, in any case, are an extra which one would rather dispense with, if some satisfactory distinctive feature could be incorporated in the switch; possibly self-luminous lettering might answer the purpose, as in the case of the numerous luminous dial watches for night use.

We note that a large number of ranges have been placed on short-period deferred payments not extending beyond a year; simple hiring-out of stoves does not seem to be practised—at any rate, it is not mentioned.

A very interesting section of the report which we particularly commend to the attention of British central station engineers, is that giving the ideas of some of the supply companies on dealing with manufacturers in order to obtain an ideal electric range at the lowest possible price; these confirm the views previously expressed in our pages*, and are summarised as follows :—

"The manufacturer should be willing to stand behind his product with a proper guarantee, and willing to defer some of the profits from the business until a future date, and not hope to make all on the first few ranges sold, but bring the price down as low as possible, and let the central station have an opportunity to put out more ranges."

"Standardise requirements of the central stations, so as to limit the types of ranges made by different manufacturers, and thus reduce their overhead expenses. Also show manufacturers that increased output depends primarily upon lower-priced ranges."

"Develop hot water attachment and durable elements."

"It seems as if a canvass of number contemplated to be used would allow greater number to be made, and this would allow cut in price, or manufacturing company could sign tentative contract to sell at certain reduced price if specified number were ordered by entire trade."

"Power companies to combine, in order to secure quantity prices."

"Standardisation of types should reduce production costs. Some method of collective bargaining between representatives of the manufacturers and central stations to establish standard designs for a pre-determined period might work to the mutual advantage of all concerned."

"Standardise and cut out novelty idea."

"A maximum production to lower unit cost."

"Through increased output, central stations could club together and order a certain number in advance."

"Dispense with nickel and frills, unless especially ordered."

"Standardise, so as to cut down manufacturers' cost."

"Study the gas range closely, and capitalise its experience."

"Let the electric manufacturers make the element and the stove manufacturers the stove."

"Ship complete line of repair parts to the distributor."

"Manufacturers should be more particular in details and mechanical construction."

"Do not load the development costs on first shipments."

"Better insulation in oven on cheaper ranges."

"Standardise on design and equipment. Reduce number of types of ranges, and talk quantity to the manufacturers."

We again take the opportunity of urging those interested in promoting electric cooking in this country to abandon the haphazard systems of the past in regard not only to design, but also to manufacture and marketing of the electric stove.

It is useless to attempt to grapple with an immense business, such as electric cooking has a good prospect of becoming, on any but commercially-organised lines, the logical essentials of which are quantity production on standardised lines, interchangeability of parts which may have to be replaced by the user, and mutual guarantees as between manufacturers and supply authorities as regards price and disposal of output.

Only in some such way as this—with present electric-heating methods—can we hope to place electric cooking on a really competitive basis and to achieve real success with it.

THE BRITISH ASSOCIATION.—V.

Address to the Economic Science and Statistics Section.

By Prof. A. W. Kirkaldy, M.A., President of the Section.

(*Abstract.*)

(*Concluded from page* 364).

Industrial Organisation.

The industrial army of labour force of this country includes all those who either organise industry or take any part, however important or however humble, in its working, from the captain of industry down to the humblest weekly wage-earner. In connection with this force we now have two sets of organisations whose interests some people consider to be antagonistic. I would emphasise the fact that these two are really one force, their main interests are identical, and they can best serve those interests by striving to minimise differences and by doing all that is possible to work in harmony.

British trade unions have a fairly long history behind them, and may be said to be in advance of any similar unions the world over. But the fact that of recent years there has been a tendency for small unofficial sections of given unions to kick over the traces and disregard the policy and agreements of their leaders shows that perfection of organisation has by no means been attained.

Employers' associations are of more recent formation, nor have they so far attained to anything like the same completeness. Both organisations, especially the employers', are in need of further development. The economist can point to imperfections and make suggestions—only those conversant with practical working facts can formulate a practical policy. The individual British business man is unexcelled by the business man of any other country. In times of rapid transition and crisis he has again and again shown his leadership. He knows his business thoroughly, and as a working unit he has taken a very high place. But one of the most marked developments of modern trade is a growing interdependence of industries. Hand in hand with this we have become familiar with another phenomenon, the amalgamation of businesses of various dimensions into one great company or corporation. This phenomenon is common to both commercial and manufacturing interests. It is as marked among banks as among steel and iron companies. The comparatively small manufacturer or business man is giving place to bigger and inclusive organisations. These two and somewhat parallel developments are making a new demand on the individual. He and his predecessors exemplified individualism; the new stage upon which we have entered demands a modification of the old policy. Business, like everything else, is subject to evolution, and evolution on healthy lines can only be obtained by grasping fundamental facts and applying experience in accordance with economic laws. There need be nothing revolutionary about the required changes in our business organisation. We merely have to note what has already occurred, mark healthy tendencies, and clear away or prevent obstructions to natural growth. Our past history amply justifies us in pursuing this policy without uncertainty as to the result. Our entire industrial history is one of the best examples of steady and, on the whole, well-ordered evolution. We have shown our ability to adapt ourselves to the needs of the moment. As a race we are healthily conservative without being reactionary—that is to say, we know how to preserve what is good in the old and amalgamate it with the new. In other words, our organisation enjoys that useful quality of elasticity which enables us to keep abreast of the times.

Our business man's qualities emphasise his defects. For generations our business men have worked as units, and individualism has become almost second nature. The call now is that the individual shall sink a part of his personality and become, so far as one side of his activities is concerned, a member of an association. We have had employers' alliances, federations, and associations. Some have failed, some have managed to keep afloat, others have had a certain amount of success. None have hitherto quite attained to what is required. To the onlooker it would appear that when our employers meet as an association there is a lack of sympathy among the members, and if this should persist it would be fatal. Each individual knows his own business; he does not know, and perhaps it would be true to say he does not care to know, his neighbour's concerns. At any rate, as a result there is a lack of cohesion, there is a lack, too, of that co-operation which is required if the association is to be really successful and accomplish the objects for which it has been formed. This working in co-operation, the large organisations of capital, and the working together in associations, are comparatively new things to our business community. Time and experience will put things right; at present we have not accustomed ourselves to a newly-developing condition of affairs. Our business men, then, need to focus their attention on these early ailments of the movement and get them removed as soon as possible.

A second group of defects arises indirectly, but almost inevitably, from that which has just been considered. Some alliances, rings, and associations have failed and come to an end. And in certain cases the cause has been unmistakeable, for there has been a lamentable want of loyalty, and even i me cases it must be said honesty, to the agreements e d into by by the association.

Only to mention one group as an instance of this—the new trades combination movement, which caused quite a considerable stir during the late 'nineties of last century, especially in the Midlands among the metal trades. Articles appeared in the journals, and a book was written explaining the movement, and great hopes were entertained that a new era had opened out before both Capital and Labour. But all ended in a failure. There was for a time a kind of syndicalism—a syndicated industry enabling employers to increase their profits, and the workpeople to earn abnormally high wages. So long as competition could be kept out of the market, things went swimmingly, and a specious prosperity developed. But the consumer was being exploited—the increased prices charged for such goods as metal bedsteads gave would-be competitors and unscrupulous members of the alliance their chance. The cheap wooden bedstead, however, made its appearance on the one hand, and on the other there were such things as secret discounts and commissions, and this special alliance ended in failure. The history of that short, but industrially instructive, movement has yet to be written. Its cardinal facts should be known to those who now have an opportunity for shaping the industrial future of this country. Three lessons stand out from this experience :—

1. We must learn to work together in association.

* Electrical Review, January 14th, 1916.

2. All members of an association must be absolutely loyal and honest to their engagements, either written or implied.

3. Such associations must be regulated or the community will be exploited.

Nor is it impossible to suggest a method by means of which this may result. When employers' associations have justified themselves it should be possible to obtain State recognition for them, and it would be practical politics, when both employers' associations and trade unions have developed to the point at which both merit State recognition, to enforce under penalty agreements made between them on all those, either employers or workpeople, who wished to work at the industry within the area under the recognised organisations. Thus it would not be necessary to make membership compulsory; self-interest would be the extent of the pressure.

Turning to workpeople's unions, we also find defects which require removing. The policy of union has been practised among the workers for upwards of a century, and for at least half that time with well-marked success in certain directions. In the first instance it was the aristocracy of labour that realised the advantage of collective action, but, notably since the late 'eighties of last century, efforts have been made to extend the policy to all grades of labour. Hence the ailments which have to be noted are rather more mature than those affecting employers' associations. Success in certain directions has perhaps led some of the more ardent spirits to expect more from their unions than working conditions allow. The experience of old and tried leaders has led them to adopt a more cautious policy than the young bloods are inclined to accept. Hence there has been a want of loyalty, different, it is true, from that met with among employers, but equally disastrous if persisted in to the object in view.

All the men in a given industry should be members of the union, provided that the union is well organised and ably administered. This should, however, be the result of self-interest and a regard for the good of fellow-workers, rather than of compulsion; how that may be attained has been suggested. Perfection of organisation will come when workpeople not only realise the real possibilities of collective action, but are prepared to follow loyally leaders who have been constitutionally elected. The leaders are in a better position to know the facts of the case immediately under review, but if their leadership has been found faulty there should be adequate machinery for replacing them with men who command the confidence of the majority of the members. When agreements have been entered into, the terms should be implicitly observed, even though they may turn out to be less advantageous than was expected. Periodical revision would make it possible to rectify mistakes or misapprehensions. But it cannot be too strongly emphasised that for both sets of organisations the great factor making for smooth and satisfactory working is absolute loyalty to the pledged word. A large employer of skilled labour writing to me on this point said: "In my opinion no industrial harmony can exist between employers and employés until trade unions through their executives can compel their members to adhere to and honourably carry out all agreements entered into with the employers. . . . In fact, until a more honest code of morals exists on both sides no improvement can be looked for."

Further, there is a need for a more complete and authoritative central authority, both for individual industries and for federated trades. The machinery for this exists; it merely requires development. When the local and central machinery has been perfected, the right to *strike*, which, in common with the right to *lock out* as a final resource, should be jealously maintained, would be carefully regulated, and would only be resorted to as the considered judgment of the most experienced men on either side. It should be impossible for either an individual association or a section of it to order a strike or a lock-out on its own responsibility.

What, then, do I consider should be the main outline of industrial organisation? Employers should be organised into:—

(*a*) Associations of one trade in a given district.
(*b*) National associations of one trade.
(*c*) Local federations of trades.
(*d*) National federations of trades.

Of these, *b* and *d* should be organised under a system of representation.

Workpeople should have unions and federations corresponding to those of the employers, and in both cases the national federations should be carefully organised councils who would enjoy a large measure of authority, tempered by the necessity to win and preserve the confidence of their electors. From these two representative bodies there could be elected an industrial council as a court of appeal, representative of the whole industrial activity of the country, and so far as these various bodies were approved by the State they would enjoy far-reaching powers.

Approval by the State should depend on the observance of moderation and working in conformity with carefully devised regulations. For the State in this matter would be the representative of the consumer and of the national interest. Without this you get something not very far removed from syndicalism, but under careful regulation abuses might be avoided.

At the head of the organisation there would be a real industrial council representing the industry of the country. The Industrial Council established in the year 1911 has never had a fair chance to show its mettle. It was established at a critical time; perhaps the Government did not feel justified to throw a great responsibility on an untried body. Nevertheless, it exemplified a very wise policy, and one regrets that it has not been tested, for even now both employers and workpeople feel that some such council is preferable to State interference, and there is a clearly articulated distrust on both sides of official arbitration.

We do not need at the present juncture to attempt a new experiment. Our old system, whatever its failings, has been tried and proved sound. Its elasticity has been its salvation, and it is capable of still further evolution without calling for drastic changes. The improved organisation that is now suggested would contain nothing that is new or untried. It would consist of natural developments of what already exists. Employers and workpeople have organised themselves into associations and unions, some of these have developed federations of similar or even of unconnected interests; and both parties have their national congresses, or at any rate the germ of them. The demand now is that the organisations already in existence be perfected, and that those perfected organisations shall in all their agreements be loyally and honestly supported by their members. Success depends on absolute loyalty to the pledged word.

Here we have a practical policy suited to the needs of this critical stage in our history. The ideal organisation has yet to be formulated, but what is here proposed would form a definite step in advance, and the very elasticity of the system would be a good augury for the future.

Among the innovations recently introduced into this country, and one calculated to have important effects on our industrial well-being, is automatic and semi-automatic machinery. We have been accustomed to the use of labour-saving machines—indeed, this country was the birthplace of many of them. The re-equipment, however, of our factories for war purposes, both in tools and workpeople, has wrought a revolution comparable with that effected by the introduction of the steam engine.

From the point of view of craftsmanship our old system had much in its favour. Our mechanics in certain trades had to be highly skilled, for the description of work turned out made considerable demands on the operative. In America and Germany standardisation has been carried very much further than in this country, and consequently repetition work was much more generally practised than with us.

One may grieve over the passing of our old methods, as one is sometimes tempted to regret the days of cottage industries. Neither, however, is compatible with modern conditions, and an important part of the work of reconstruction and reorganisation will be connected with standardisation and the further introduction of repetition work. This will call for the exercise of careful and experienced industrial statesmanship, if trouble is to be avoided, for agreements will have to be framed which will in the long run work equitably and satisfactorily to all the parties concerned.

A Committee of this Association has been investigating for the past two years into the extent to which women have recently replaced men in industry. A certain amount of exaggeration exists as to the number of women who have entered our factories or undertaken services left vacant by men who have joined the Forces. The total number is in round figures about 600,000, as against five million men who have joined either the Navy or the Army as a consequence of the war.

The entry of large numbers of women into industry has been viewed with a certain amount of alarm by the men, and trade unions have naturally stipulated, where possible, that these women shall receive the same rates of pay for the same work as the men, and that when the men return the women shall give place to them.

That there was little ground for alarm as to the influx of women can be realised by a consideration of a few facts and figures. The majority of men who enlisted were workpeople of one sort or another; of these, unhappily, some have been killed in battle or have been rendered incapable for work. Even so, the majority will come home requiring occupation. What opportunities will they find?

To answer this question at all satisfactorily it is necessary to consider some determining factors. Thousands of men have left indoor occupations and their accustomed town life and have been trained, drilled, and disciplined under open-air conditions. They have lived, worked, and fought in the open country in some cases for many months. The new experience has had potent effects. Physique has improved, the outlook on life has changed, in many cases new hopes for the future have been formed. Inquiry shows that there is a division of opinion as to the extent to which disbanded members of the Forces will decide on making a radical change in their mode of life. Yet the experience of what occurred after the South African War warrants us in assuming that considerable numbers will only return to indoor occupations and town life if there be no alternative. It is too soon yet to form an opinion as to what opportunities there will be for land settlement. But it is known that offers will be made both at home and in various parts of the Empire. A moderate estimate of those accepting these offers, and of our losses of killed and permanently disabled, would be at least one million. Then we shall undoubtedly require, at any rate for some years, a much larger standing Army. Even on a peace footing this at a moderate computation may be put at a million men.

These two figures, and neither of them errs on the side of exaggeration, will absorb two million men who will be permanently lost to the old occupations.

Moreover, there is good ground for anticipating that if the war concludes before our resources are unduly strained, and there is every prospect that it will, there will be a period of good trade. We have to restore our own depleted stocks of goods, our mercantile marine demands a large amount of new tonnage, railways and other transport services will require much new equipment. Turning to the Continent, parts of France, Belgium, and other of the entente countries will need reconstruction works of considerable proportions, and in this work we shall play a great part. World markets, too, have been kept short of many manufactured goods. We shall be in a position both to finance and carry on a greatly extended system of industry and commerce, for not only is our banking system prepared to face this, but our man force has been greatly improved, and our industrial equipment to a great extent remodelled.

Reverting to the somewhat thorny question of the women who have been engaged on what were men's occupations, I see no cause for alarm. Many women came forward from motives of patriotism and will gladly resume their former state. The question, I believe, will rather be how can we obtain the labour necessary to cope with the post-war demand.

The new equipment of our factories will place us in a position to increase very greatly our output, and this should enable us not only to face a possible labour shortage, but if the recommendations made by this Section of the Association meet with a favourable response, our labour force should enter upon a new period of prosperity consequent on a remodelling which has been rendered possible by a reorganisation of our industrial machinery. This new epoch for labour would include higher wages, shorter hours, and better working conditions. To effect these salutary advances both employers and employed need to exercise sanity of judgment, frankness in mutual discussions, and a recognition of the fact that the prosperity and material well-being of each is bound up in a common effort to maintain and develop our industrial and commercial position.

Electricity in the Chemical Industries.

In the course of his address as President to the Chemical Section, Prof. G. G. Henderson, F.R.S., stated that many of the more striking results in the field of modern chemical industry had been obtained by taking advantage of the powers we now possess to carry out operations economically both at very high and at very low temperatures, and by the employment on the manufacturing scale of electrolytic and catalytic methods of production. Thanks largely to the invention of the dynamo, the technologist is now able to utilise electrical energy both for the production of high temperatures in the different types of electric furnace and for electrolytic processes of the most varied description. Among the operations carried out with the help of the electric furnace may be mentioned the manufacture of graphite, silicon, and phosphorus; of chromium and other metals; of carbides, silicides, and nitrides; and the smelting and refining of iron and steel. Calcium carbide claims a prominent place in the list, in the first place because of the ease with which it yields acetylene, which is not only used as an illuminant, and, in the oxy-acetylene burner, as a means of producing a temperature so high that the cutting and welding of steel is now a comparatively simple matter, but also promises to serve as the starting-point for the industrial synthesis of acetaldehyde and many other valuable organic compounds. Moreover, calcium carbide is readily converted in the electric furnace into calcium cyanamide, which is employed as an efficient fertiliser in place of sodium nitrate or ammonium sulphate, and as a source of ammonia and of alkali cyanides. Among the silicides carborundum is increasingly used as an abrasive and a refractory material, and calcium silicide, which is now a commercial product, forms a constituent of some blasting explosives. The Serpek process for the preparation of alumina and ammonia, by the formation of aluminium nitride from bauxite in the electric furnace and its subsequent decomposition by caustic soda, should also be mentioned. Further, the electric furnace has made possible the manufacture of silica apparatus of all kinds, both for the laboratory and the works, and of alundum ware, also used for operations at high temperature. Finally, the first step in the manufacture of nitric acid and of nitrites from air, now in operation on a very large scale, is the combustion of nitrogen in the electric arc.

Electrolytic methods are now extensively employed in the manufacture of both inorganic and organic substances, and older processes are being displaced by these modern rivals in steadily increasing number. It is sufficient to refer to the preparation of sodium, magnesium, calcium, and aluminium, by electrolysis of fused compounds of these metals; the refining of iron, copper, silver, and gold; the extraction of gold and nickel from solution; the recovery of tin from waste tinplate; the preparation of caustic alkalis (and simultaneously of chlorine), of hypochlorites, chlorates, and perchlorates, of hydrosulphites, of permanganates and ferricyanides, of persulphates and percarbonates; the regeneration of chromic acid from chromium salts; the preparation of hydrogen and oxygen. As regards organic compounds, we find chiefly in use electrolytic methods of reduction, which are specially effective in the case of many nitro compounds, and of oxidation, as for instance the conversion of anthracene into anthraquinone. At the same time a number of other compounds, for example iodoform, are also prepared electrolytically.

Referring to the training for chemists supplied by the universities and technical colleges, Prof. Henderson said that the facilities for practical instruction with respect to accommodation and equipment were generally adequate, but the *personnel* could with advantage be largely increased, and at least the junior members of the staffs were miserably underpaid; if the best brains in the country were to be attracted towards science, as they ought to be, some greater inducement than a mere living wage should be held out. Hence no opportunity should be lost of impressing upon the Government the necessity for increasing the grants to the scientific departments of our higher teaching institutions, and for the provision of research scholarships. Wealthy men in this country should acquire more generally the habit of devoting some part of their means to the endowment of higher education. The private donations for science and education made in the United States during the last 43 years amounted to the magnificent sum of £117,000,000, and recently the average annual benefactions for educational purposes totalled nearly £6,000,000.

The chief difficulty which confronted those who were eager for progress in educational matters was that so many of our most famous schools were still conducted on mediæval lines, in the sense that the "education" administered was almost wholly classical. Consequently, "though science enters into every part of modern life, and scientific method is necessary for success in all undertakings, the affairs of the country are in the hands of legislators who not only have little or no acquaintance with the fundamental facts and principles signified by these aspects of knowledge, but also do not understand how such matters can be used to strengthen and develop the State. Our administrative officials are also mostly under the same disabilities, on account of their want of a scientific training. They are educated at schools where science can receive little encouragement, and they do not take up scientific subjects in the examinations for the Civil Service, because marks can be much more easily obtained by attention to Latin and Greek; and the result of it all is that science is usually treated with indifference, often with contempt, and rarely with intelligent appreciation by the statesmen and members of the public services whose decisions and acts largely determine the country's welfare. The defects of a system which places the chief power of an organisation which needs understanding of science in every department in the hands of people who have not received any training in scientific subjects or methods are obvious."* The remedy was also obvious.

Female v. Male Labour.

At a meeting of the Economic Science Section of the British Association at Newcastle-on-Tyne, on September 8th, the report was considered of the committee appointed to investigate the replacement of male by female labour in consequence of the war. The official abstract of the report follows:—

The activity of the Ministry of Munitions, the schemes for the "dilution of labour," and the scarcity of skilled male labour have brought about in the second year of the war a marked development in the demand for female labour. At the present time (July, 1916) over half a million women have replaced men who have left their occupations for more urgent national service.

The women who have taken the men's places have for the most part had previous industrial experience, though seldom (in industry proper) of the kind of work they are now doing. Many of them are married women, or single women transferred from other occupations. Generally the supply has been drawn from the neighbourhood, but some of the munitions establishments have attracted women from a wide geographical area, not always limited to the British Isles.

Besides the employment of women on tramways and railways, in banks, and as postal servants (positions open to the public view), replacement has occurred through the whole of industry. Few women are to be found taking the place of highly skilled men; but large numbers have released the unskilled and those termed, in engineering, "semi-skilled." But when the work of the men involved a degree of skill and experience which women seldom possess, new machinery of a more automatic kind has been introduced (sometimes to such an extent as almost to transform an industry), and subdivision of processes has changed highly skilled work into a series of repetition operations which can be accomplished by relatively untrained workers. This has to be borne in mind when women are stated to be doing the work of skilled men.

The success of the women on these repetition processes is marked. They learn quickly; they are good timekeepers; they have, so far at least, stood the strain of long hours extremely well, and their manual dexterity enables them to achieve good results in the way of output on repetitive processes. On work demanding greater judgment and adaptability the evidence of their success is not so great; but their industrial training has been short.

For some time the employment of women on men's processes was opposed by trade unions, which still in some in-

* *Nature.*

dustries bring forward strong objections to replacement. But in the most important industries agreements have been reached between men and employers as to the conditions on which replacement may be carried out during the period of the war. Those conditions usually include an agreement as to women's wage-rates and a guarantee of the re-employment of the men replaced.

The wages of women in war-time have been influenced by the fixing of a minimum for certain kinds of munition workers in certain classes of munition establishments; by the competition of munitions with other industries in the demand for female labour; by the pressure of the trade unions; and by the general rise in prices. The fact that even in districts where the competition of munitions is keenest the wage-rates for women in other industries, on processes involving similar skill and exertion, have not always risen to the munition level, suggests that the withdrawal of the minimum regulation, twelve months after the war, will lead to a fall in women's wages. But it is unlikely that they will fall to their general pre-war level.

The fact that not a great proportion of the women war workers were previously occupied suggests that after the war the problem of a large surplus of women may not be so serious as has been feared. The married women are for the most part in industry only for the period of the war; and inquiry among women workers generally shows that many of them have no desire to remain in competition with men. But this involves the question of the increased demand for women on repetitive processes; and if, as seems likely, the subdivision of processes and the highly automatic machinery introduced owing to war conditions have come to stay, there may be a change in the relative demand for skilled and for unskilled labour to the disadvantage of the former.

Prof. Scott (Chairman of the Committee) said women were stated as yet to be deficient in the higher industrial qualities, but they had, however, shown that they excelled in those operations which required deftness of touch, and in those operations that were of a comparatively routine character.

Gaseous Explosions.—The interim report of the Committee (Dr. Dugald Clerk, Chairman) stated that during the session most of the members of the Committee were engaged on work in connection with the war, and no Notes were submitted for consideration. Consequently the grant of £50 made to the Committee at the Manchester meeting of the Association in 1915 was not drawn upon by the Chairman. The Committee recommended that it be reappointed, and that a sum of £50 be granted to it for the ensuing session, so that should the war come to an end during that time the work of the Committee could be resumed without delay.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

War-time Generosity.

We all know that many people are badly hit by the war, but one would hardly be so venturesome as to suggest that firms carrying out Government contracts are short of cash, hence their "response" to a recent appeal for donations sent out by the Professional Classes War Relief Council, which is doing such a large and, unfortunately, necessary work, is all the more significant. 27,000 of such firms were appealed to at a cost of £216. The result of the appeal was the magnificent average contribution of 4.9d. each (*i.e.*, the total receipt from this source was £546).

For purposes of comparison, it may be stated that the same appeal was sent to 14,000 Justices of the Peace, who contributed £1,044, or an average of 1s. 6d. each, while 10,000 directors of public companies contributed £995, an average of 2s., which, to say the least of it, makes the manufacturers' 4.9d. look small, and leads me, as one of them, to sign myself

Shylock.

September 28th, 1916.

Munitions Work Wanted.

May I, as the founder of the Amateur Ordnance Volunteer Association, which aims to find munition work for home workers who are debarred from any other form of national service, ask the favour of your kind interest in making our wants known to any of your readers who can find us any repetition work, fine screw-bolts and straining eyes, taper pins, or any small munition components? We are at present on shrapnel sockets for the Ministry, but these are a little too complicated to employ all our workers. We have been doing shell bases, which we can do well up to the 6-in. sizes. Both Messrs. Armstrong and the Ministry speak well of our work, and it seems a pity for thousands of pounds' worth of precision tools and workers trained on model making to work within fine limits, to be standing idle at this crisis. We only want to be helpful, not competitive, and we make no personal profit. Should any of your readers see an opening for us, would they be kind enough to communicate with me?

(Rev.) W. M. W. Pitchford.

Lamport Rectory, Northampton, *September 27th.*

The Institution Wiring Rules.

We have read with interest Mr. Smeaton Munro's remarks in the Electrical Review of September 29th, particularly those dealing with Rule 68, and have little doubt that some of them refer to the Henley wiring system.

We think some comment is desirable in reply to his remarks as to the "special metal" sheathing to which he refers. It is true that it was, and still is, considered necessary to specify a high percentage of pure lead for cable covering generally. This is to ensure that the lead is refined and free from deleterious matter, whereas the "special metal" sheathing in question is composed of an alloy of pure lead and other metals which are mixed with it in certain predetermined proportions for specific purposes, which is quite a different thing from using impure lead.

Mr. Munro may also be interested to know that we have supplied considerable quantities of our "special metal" sheathed wires covered with compounded tape for special situations.

We are pleased to see that Mr. Munro considers that lead-covered systems are better than some of the other systems that are permitted more freedom under the rules. Lead-covered wiring has been used for very many years, but failed to grow in popularity owing to the absence of suitable fittings and means of earthing until the introduction of the Henley wiring system some five or six years ago.

We can assure Mr. Munro that the host of contractors, and even consultants, to whom he refers do not regret having what he calls "risked the experiment," but we suggest that it can hardly be called an experiment now, in view of the length of time and the large amount of work that has been carried out under the system.

W. T. Henley's Telegraph Works Co., Ltd.

London, E.C., *October 2nd*, 1916.

Closing Down The Electrical Co., Ltd.

With reference to the closing of enemy businesses, I was extremely glad to note in the paper some considerable time ago that the Electrical Co., Ltd., was to be closed, but until I received a notice regarding the sale of their stock I was not certain whether this was not another case of closing an enemy business and keeping it warm until such time as the enemy was able to come back to it, in a similar manner to that of the Sanatogen Co.

I note on the advertisement sent me a foot-note, which states: "The Controller, Mr. Maurice Jenks, is prepared to receive offers for the trade and business connections as lately carried on by the above company," and I am of opinion that this is directly opposed to the question of closing the enemy concerns down, as it simply leaves a loophole for the present owners to purchase the business and keep it going until such time as the war is ended.

There seems to be a good deal of explanation required by the public with regard to this so-called closing of enemy businesses, as if the authorities are serious in saying that the business is closed, this should mean that the whole concern is done away with and the stock sold.

Contractor.

To Go—or Not to Go?

In reply to "North-East Coast," I am not "fed up," nor am I "one of those young men perpetually permeated with the spirit of discontent," nor even "one who has come to pick up all the information they can in order to better their positions," and in support of this, if "North-East Coast" will guarantee me a decent living wage with progression according to ability after the war, I shall stop where I am; in fact shall be glad to do so. I do not want what some North-East Coast officials call a living wage—it is not so long ago since a certain one highly-placed in that quarter made the statement that £1 per week was enough for any single man to live on. "Ye Gods!"

He goes on to refer to the speeches made before the British Association, and makes the statement that only semi-skilled labour is necessary for the operation of power stations and *systems*; if so, I don't want a system engineer's position. "N.E.C." will find plenty of women nowadays to undertake semi-skilled and repetition work. As for the combination of mechanical with electrical experience, I should like to know in what manner does "N.E.C." find where it lies. Does he expect it to show itself from the man on the switchboard with full leave to inspect his oil rings hourly, or maybe to replace a burnt-out lamp?

In turn, I refer "N.E.C." to a paper read by Mr. R. P. Sloan before the B.A., in which he states that the present high-class state of electrical affairs on the Tyne has been brought about by utilising . . . . to the best advantage with the aid of a highly skilled technical staff (Electrical Review, p. 334). Yet skilled labour is not needed.

Perhaps if I did stick it for so long as there are volts on

the system I *might* be able to keep myself. I think if the young man of to-day between 18 and 24 years of age cannot keep himself without aid from home to the extent of half his wages it might be as well if this war should see the end of the world.

Balanced Up.

In reply to your correspondents "Unsettled," "Balanced Up," "North-East Coast," and "Industrial Conscript," my advice is to clear out of station engineering as quickly as possible, as the prospects do not compensate for the trouble and time taken to become a station engineer. Fortunately, the war cannot last for ever, and as soon as things are normal again, with no controlled firms to hamper your movements, and decide how much work you have to do, for the "salary" they choose to offer you, I say look out for something else; there is not much fear of its being any worse. I, for one, will never again take a "starred" employment, and when I get my discharge from the Army, after the war, if England is not once again a free country, as of yore, it will never see me again.

My own experience is very similar to that of "B.U.," inasmuch as I have been associated with the North-East Coast for a number of years, but, fortunately, I am now out of station engineering of from 1 to 20,000 volts, and most fervently say, "Never again!"

"N.E.C." rather gives me the impression that he is closely associated with some of those patriotic employers who regard nearly all their employés (on pay days) as semi-skilled, and themselves as benevolent teachers. Let us, for their sake, hope that after the war is over the process of "unbadging" will take a few days, as they otherwise might find their staff reduced to a few old hands, without interest or prospects in life.

Safely Out.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NICARAGUA.—The Board of Trade have received a copy of the Nicaraguan Law of July 7th which provides for a general increase of the Customs duties leviable on goods (with certain exceptions) imported into Nicaragua, by 33⅓ per cent. (*not* 38⅓ per cent. as originally reported by H.M. Consul at Managua—see the Electrical Review of August 18th).

The Law, which came into force on the date of publication, viz., July 17th), authorises the collection of import duties at the rate of 80 cents to the peso of the Tariff, in place of 60 cents, as hitherto, the effect being that the duties are increased by one-third. This increase is the same for all goods, with a few specified exceptions.

TRANSIT OF GOODS THROUGH FRANCE.—Certain amendments have been made in the official statement published on May 11th—see the Review of June 9th—giving particulars of the arrangements for transit through France of goods sent from the United Kingdom to Switzerland, Italy, and Spain *viâ* France. Full information on the subject can be obtained from the Commercial Intelligence Branch of the Board of Trade.

SWITZERLAND.—A list of articles in respect of which licences for export to Switzerland are only granted if the goods are consigned to the Société Suisse de Surveillance Economique has been issued by the Contraband Department of the Foreign Office. The list includes electrical and allied goods as follows:—Accumulators, electric, and accumulator plates; *batteries, electric and parts;* cable, insulated; carbons (electric)—*carbons for electricity* (except electrodes) *and carbon brushes for dynamos can be sent under the small parcel scheme* (see below); copper wares, including carbons for electricity containing copper, and including all metal articles containing 10 per cent. or more of copper and its alloys; perforated copper plates; copper leaf; copper cables, insulated and non-insulated; insulated electric copper wires; copper cables with lead sheath, or iron fittings; electrical cables of all kinds containing copper; electrical appliances adapted for use in war, and their component parts; electrical fire lighters; electrical insulated wire cables; electrodes, piles, and component parts; *gloves, rubber;* electrical machinery, electric dynamos, and motors; magnetos and their parts; metal, anti-friction; mica, crude or in sheets; mica splittings, ground mica and mica wares; rubber, viz., balata, gutta-percha, rubber wares, rubber-proofed and rubber-mixed goods, and rubber preservatives; rubber, vulcanised, in sheets; searchlights; shoes, rubber; *telegraph and telephone apparatus, parts of;* telegraph and telephone materials; and wire, insulated.

The articles printed in italics are allowed to benefit under the special scheme for small parcels, *i.e.*, they may be exported to Switzerland without an acceptance certificate being previously obtained from the S.S.S. Parcels thus exported, whether by post or otherwise, must nevertheless be consigned to the S.S.S. for the account of the ultimate consignee *viâ* the International Postal Parcels Bureau, Pontarlier.

[It should be noted that articles or substances composed wholly or partially of products named in the list must themselves be consigned to the S.S.S.]

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

13,198. "Electrical fuses or cut-outs." H. W. Cox. September 18th.

13,221. "Method of adapting tungsten, &c., for contacts in magnetos." G. A. Rignon. September 18th.

13,235. "Incandescent electric lamps." C. E. J. Brandt. September 18th. (France, September 18th, 1915.)

13,237. "Telephone systems." R. C. M. Hastings. September 18th.

13,251. "Telegraphy." J. S. Withers, K.C. (Cox). September 18th.

13,269. "Electrical signalling." L. W. Austin, L. Cohen & G. O. Squier. September 19th.

13,277. "Telegraphy." L. W. Austin, L. Cohen & G. O. Squier. September 19th.

13,279. "Production of electric currents." J. F. Sepulchre. September 19th.

13,294. "Electric ignition systems employing magneto-electric machines." British Thomson-Houston Co. & A. P. Young. September 19th.

13,302. "Ignition magnetos." L. Bignon & J. C. Rousset. September 19th. (France, September 21st, 1915.)

13,303. "Transmitting apparatus of radio-telegraph and radio-telephone stations." F. G. Simfson. September 19th.

13,304. "High-tension electric current collecting and transmitting or conducting devices." Etablissements de Dion-Bouton Soc. Anon. September 19th. (France, November 8th, 1915.)

13,314. "Ships' stokehold, &c., telegraphic apparatus." W. Chadburn and W. R. Chadburn. September 20th.

13,342. "Electrically depositing metal." E. H. Jones. September 20th.

13,343. "Method of forming metal electrodes used in electric-arc soldering and deposition of metals." E. H. Jones. September 20th.

13,366. "Automatic and semi-automatic telephone systems." T. M. Inman and The Relay Automatic Telephone Co. September 20th.

13,383. "Vacuum tubes." M. O'Gorman & R. Whiddington. September 20th.

13,390. "Electric pocket lamps, torches, &c." E. A. Bellow. September 21st.

13,422. "Electric lampholders of the Edison screw type." B.T.H. Co. and A. N. Bunn. September 21st.

13,439. "Production of electric currents." J. F. Sepulchre. September 21st.

13,443. "Dynamo-electric machines." Anschutz & Co. September 21st. (Germany, September 22nd, 1915.)

13,458. "Electrical warning apparatus." J. Bein. September 22nd.

13,483. "Storage battery plates." A. E. White (U.S. Light & Heat Corporation). September 22nd.

13,486. "Electrically-heated soldering bolt or bit." F. Husband & A. E. Woodhouse. September 22nd.

13,487. "Galvanic batteries." J. E. Preston. September 22nd.

13,488. "Automatic telephone systems." B. B. Johnson. September 22nd.

13,489. "Automatic telephone systems." L. C. Bygrave, H. J. Herink, The Relay Automatic Telephone Co. & F. M. Ward. September 22nd.

PUBLISHED SPECIFICATIONS.

1914.

24,629. Regulating Means for Electrical Installations. Soc. Anon. des Etablissements L. Bleriot. December 24th. (December 27th, 1913.)

1915.

519. Polyphase Generator for High-frequency Currents with Polyphase Tuned Spark Gap. L. Rouzet. January 12th. (January 12th, 1914.)

8,334. Dynamo-electric Power Transmission Apparatus of the Unipolar Type. M. Breslauer. June 4th. (June 4th, 1914.)

8,451. Printing Telegraph Systems. A. D. Cardwell. June 7th.

11,412. Spooling Machines specially applicable for the Winding of Coils for Electrical Apparatus. Walter McGee & Son, Ltd., and A. G. Walls. August 7th. (Cognate application, 14,994/15.)

12,644. Electric Testing Apparatus. J. C. Crozier & W. G. Wheller. September 3rd.

12,781. Electric Lighting of Vehicles. P. F. Smith & V. S. Robinson. September 7th.

12,792. Electric Incandescent Lamps. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 7th.

12,936. Washing Apparatus for use in connection with Secondary Storage Batteries. O. Oldham. September 9th.

12,984. Electrical Cooking Apparatus and Switchgear therefor. F. S. Grogan & E. W. B. Burder. September 10th.

13,283. Means for Regulating the Output of Dynamo-electrical Machines Driven at Variable Speeds. N. E. Dufty. September 17th.

15,057. X-ray Apparatus. E. E. Greville. October 25th. (Addition to 21,609/14.)

15,222. Combined Electric Lampholder and Detachable Shade Support. G. St. J. Day. October 28th.

15,427. Combined Electric Switches and Plug Couplings. J. B. McIndoe. November 2nd. (Cognate application, 6,258/16.)

16,471. Method for Producing Durable Primary Galvanic Battery Cells with Zinc Anodes and Alkaline Electrolyte. J. N. Bronsted & Hellesens, H. Enke & V. Ludvigsen (firm of). November 22nd.

16,516. Electric Batteries. F. J. Beaumont. November 23rd.

16,731. Portable Battery Lamps. C. A. Vandervell. November 26th.

17,480. Construction of Cord Gripholder for use in connection with Electrical Apparatus. G. Markt. December 14th.

1916.

The numbers in brackets are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

412. Switching Devices for Starting Internal-combustion Engines. R. Bosch (firm of). January 11th, 1915. [100,017.]

3,758. Machine Switching Telephone Systems. Western Electric Co March 19th, 1915. [100,198.]

6,044. Method of and Means for Assembling and Uniting or Connecting together Accumulator Plates. A. Allegranza. April 27th, 1916. [101,321.]

7,258. Call Distributing Telephone Systems. Western Electric Co. May 22nd, 1915. [100,535.]

8,211. Printing Telegraph Systems. A. D. Cardwell. June 7th, 1915. (Divided application on 8,451/15.) [101,329.]

8,285. Portable Electric Lighters for Gas. R. W. Sanders. June 12th, 1916. [101,330.]